THE
physical therapy REVIEW

37th Annual Conference
American Physical Therapy Association
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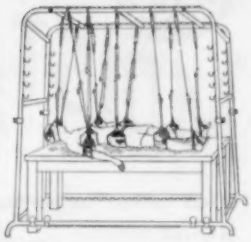

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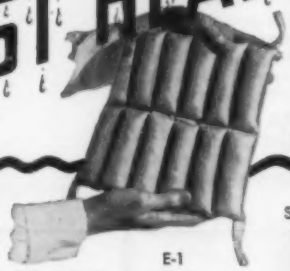

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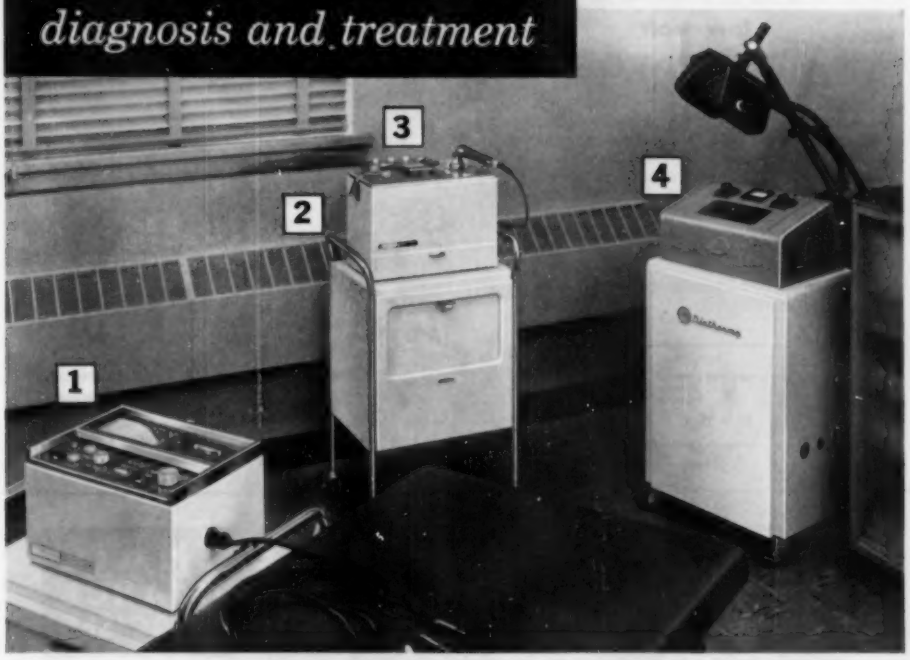

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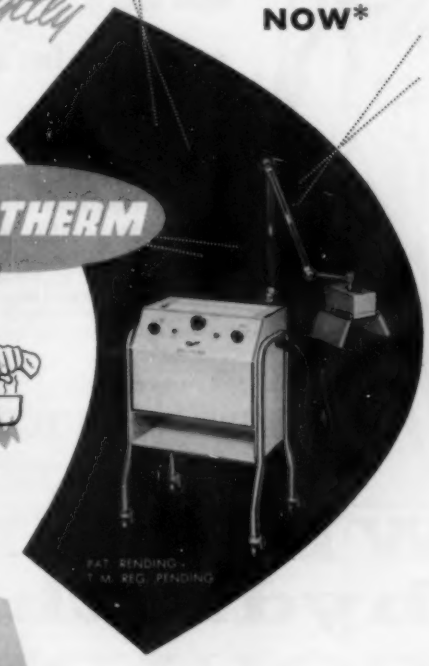

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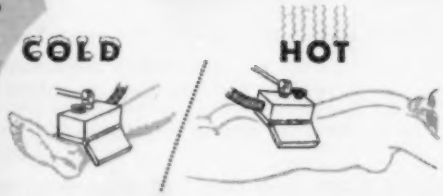

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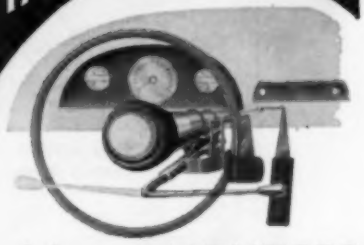

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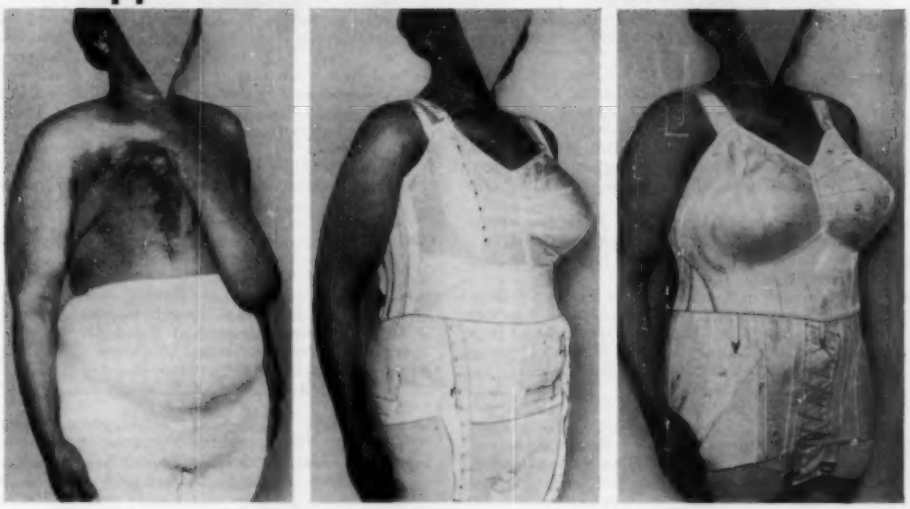

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Arizona*: Apply to June D. Walker, Sec., 1838 N. 37th Place, Phoenix.

Arkansas*: Apply to Joe Verser, M.D., Sec., Board of Physical Therapy Examiners, Harrisburg.

California*†: Apply to State Board of Medical Examiners, 1021 "O" St., Room A547, Sacramento 14. Examinations held in Los Angeles and San Francisco. SPECIFY REGISTRATION FORM

Colorado*†: Apply to Adelaide Doing, Sec., State Board of Physical Therapy, 4200 E. 9th Ave., Denver 20.

Connecticut*†: Apply to Sarah C. Johnson, Sec., Board of Examiners for Physical Therapists, 436 Capitol Ave., Hartford. Examinations held in Hartford.

Delaware*†: Apply to State Examining Board of Physical Therapists, 302 Waverly Rd., Wilmington 3.

Florida*†: Apply to Homer L. Pearson, M.D., Sec., State Board of Medical Examiners, 901 N.W. 17th St., Miami 36.

Georgia*: Apply to C. L. Clifton, Joint Sec., State Examining Boards, 224 State Capitol, Atlanta.

Hawaii*†: Apply to Department of Health, P.O. Box 3378, Honolulu.

Illinois†: Annual examination, third Friday of October. File applications 15 days in advance. Apply to Judge Vera M. Binks, Director, Department of Registration and Education, Capitol Building, Springfield. Examinations held at 160 No. La Salle St., Chicago.

Indiana: Annual examination. Mid-June. File applications by May 15. Apply to Ruth V. Kirk, Exec. Sec., State Board of Medical Registration and Examination, 538 K. of P. Building, Indianapolis 4. Examinations held at Indiana University Medical School, 1100 W. Michigan, Indianapolis.

Kentucky†: Semiannual examinations, April and October. File application by March 1 or September 1. Apply to Agnes Shehan, Sec., State Board of Physical Therapy, Kentucky Crippled Children Association, 982 Eastern Parkway, Louisville 17. Examinations held in Frankfort.

Maine: Thrice yearly examinations. Apply to Stephen A. Cobb, M.D., Sec. Medical Examining Board, 34 Winter St., Sanford. March and November examinations held at Portland City Hall, Portland; July examination held at State House, Representative Chambers, Augusta.

Maryland*: Apply to State Board of Physical Therapy Examiners, 301 W. Preston St., Baltimore 1.

Massachusetts†: Semiannual examinations, April and October. File application two weeks in advance. Apply to Board of Registration in Medicine, State House, Boston 33. Examinations held at State House, Boston.

Minnesota*: Apply to State Board of Medical Examiners, 230 Lowry Medical Arts Building, St. Paul 2.

Nebraska*: Apply to R. K. Kirkman, Dir., Bureau of Examining Boards, Room 1009, State Capitol Building, Lincoln.

Nevada*†: Semiannual examinations. Apply to Margaret Heidrich, 506 Humboldt St., Reno. Examinations held in Reno or Las Vegas.

New Hampshire*†: Apply to Edward W. Colby M.D., Sec., Board of Registration in Medicine, 61 So. Spring St., Concord. Examinations held at State Health Building, 61 So. Spring St., Concord.

New Mexico*: Apply to Registrar, Physical Therapists Licensing Board, Box 2206, Santa Fe.

New York: Semiannual examinations; June and December. File applications at least 30 days in advance. Graduates of registered curriculum apply to John W. Paige, Chief, Bureau of Professional Examinations and Registrations, 23 South Pearl St., Albany 7; graduates of nonregistered curriculum apply to Robert C. Killough, Jr., Assistant Commissioner for Professional Education, 23 So. Pearl St., Albany 7. Examinations are held in Syracuse and New York City.

North Carolina*†: Semiannual examinations. Apply to Edith M. Vail, Sec., Dept. of Physical Therapy, N. C. Baptist Hospital, Winston-Salem.

North Dakota*†: Apply to Harriet Deery, Sec., State Examining Committee for Physical Therapists, Crippled Children's School, Jamestown. Examinations held in January and July. File applications one month in advance.

Ohio: Apply to: Herbert M. Platter, M.D., Exec. Sec., Ohio State Board of Medical Examiners, 21 W. Broad St., Columbus.

Oklahoma*: Apply to Lucy Haidek, Exec. Sec., Board of Medical Examiners, Braniff Building, Oklahoma City. Examinations held at Board of Medical Examiners, Braniff Building, Oklahoma City.

Oregon†: Apply to Oregon State Board of Health, 1400 S. W. 5th Ave., State Office Bldg., Rm. 866, Portland 7.

Pennsylvania†: Semiannual examinations, January and July. File application December 15 or June 1. Apply to Marguerite Glass Steiner, Sec., State Board of Medical Education and Licensure, Box 911, Harrisburg. January examination held in Philadelphia; July examinations held in Philadelphia and Pittsburgh.

South Carolina*†: Apply to Ruth S. Linley, Sec., State Board of Physical Therapy Examiners, 319 Walker St., Columbia.

South Dakota*†: Apply to John C. Foster, Exec Sec., State Board of Medical and Osteopathic Examiners, 300 First National Bank Bldg., Sioux Falls.

Tennessee†: Annual examination, second Monday in June. File application one month in advance. Apply to Board of Medical Examiners, 1635 Exchange Bldg., Memphis. Examinations held in Nashville.

Utah: Annual examination first Tuesday in May. File application two weeks in advance. Apply to Frank E. Lees, Director, State Department of Registration, Room 318A, State Capitol Building, Salt Lake City.

Vermont*†: Apply to Sophie Myers, Sec., Board of Physical Therapy Registration, De Goesbriand Memorial Hospital, Burlington.

Virginia†: Semiannual examinations, February and September. Apply to State Board of Medical Examiners, 631 First St., S.W., Roanoke. Examinations held at Medical College of Virginia, Richmond.

Washington†: Annual examination, May. File applications by April 1. Apply to Professional Division, Department of Licenses, Olympia. Examinations held in Seattle.

Wisconsin*: Thrice yearly examinations, April, Mid-September and at the discretion of Examining Committee. File applications at least two weeks in advance. Apply to Emma Zitzer, Sec., Physical Therapy Examining Committee, 207 North Brooke St., Madison 5. April examination held in Milwaukee; September examination held in Madison.

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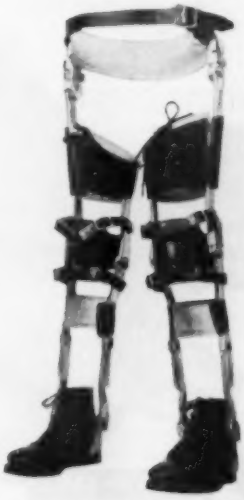

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The Physical Therapy Review

Official Publication of The American Physical Therapy Association

*Massage for the Relief of Pain: Anatomical and Physiological Considerations**

Miriam Jacobs, M.S.

Introduction

In our zealous efforts to overcome the old stigma that physical therapy and heat and massage are synonymous, there has been a trend to relegate massage to a position "somewhat below the salt" —like a country cousin whose dress is not quite fashionable enough for the party.

There is an element of danger in our enthusiasm to promote awareness of the total scope of physical therapy, that with the de-emphasis of massage this efficacious and ancient therapeutic tool may be totally abandoned to the limbo of the nonprofessional. This trend has reached the point where many physical therapists are reticent to acknowledge massage as an important therapeutic medium for fear of being considered unprogressive. Evidence of this general trend is reflected in the fact that since 1940, only five articles on massage have appeared in the *Physical Therapy Review;* and during the past five years, only five articles have even mentioned massage. One of these was the Kruse report of May, 1959, on "Current Trends and Practices in Physical Therapy" based on a questionnaire answered by 3,121 working physical therapists, approximately 50 per cent of whom were employed in general hospitals.[1] In the massage category the report indicates that 19 per cent of the physical therapists have never used friction massage, 9 per cent have not used it in the past five years, and 20 per cent use it only occasionally during the course of a year; 20 per cent of the physical therapists have never used facial massage, 12 per cent have not used it in the past five years, and 30 per cent use it occasionally during the course of a year. Perhaps the categories listed do not give the complete picture on the use of massage but it does indicate the general trend if we consider that 19 per cent of the physical therapists reporting have never used friction massage, one of the fundamental movements.

Skillful massage is in danger of becoming a lost art to physical therapy in the prevailing interest in bigger and better gadgets and the "latest" technics. Perhaps an analysis of massage in the current terminology is in order and may serve to restore it to its proper place as an important therapeutic medium.

All knowledge comes to us through our sense organs. Our simplest motor acts are initiated through sense organs and our most complicated motor acts are controlled by means of them. Utilization of the sensory mechanism, the mechanism for learning,[1] forms the basis for physical therapy. If we analyze most physical therapy procedures in basic terms, we are providing a

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* Presented at the Annual Conference of the American Physical Therapy Association, Minneapolis, June, 1959.

sensory input to promote or facilitate a motor output whether we are using heat, cold, muscle reeducation, resistance, electrical stimulation, brushing, tapping, pounding, tendon stimulation, pattern movements, confused motions, automatic associated movements, passive or active exercise, coordination and rhythmic exercises, gait training, posture training, or massage, to mention only a few. Our procedures are directed toward stimulation of certain of the sensory receptors which mediate sensations classified clinically as visual; auditory; vestibular; cutaneous sensations of touch, pressure, warmth and cold; deep sensations which include deep pressure, and muscle, tendon, and joint sensibility or proprioception. Massage is specifically concerned with the stimulation of sensory receptors which mediate touch, pressure, and proprioception for the purpose of producing certain reflex responses, as in other physical therapy procedures. It is indeed a facilitation technic in the sense that it promotes function.

History of Massage

We are concerned in this discussion with the application of massage for the relief of one of man's major concerns—pain. Probably more than any other symptom, pain is responsible for the referral of patients to the physical therapy department. Massage has long been used as a means of alleviating pain—probably since the beginning of time. When pain or discomfort occurs, the common response is to apply manual pressure or to massage the part.

It appears to be an instinctive response to pain, not only in man but in animals, as evidenced by the manner in which a dog or cat will treat an injured part by rhythmic stroking with the tongue. That pain is favorably influenced by massage was not questioned by our forebears. Thus, this instinctive and effective method of alleviating pain has been elaborated into various complex systems of massage by many civilizations throughout the ages. Unfortunately, this simple and effective remedy for the relief of pain has been exploited at various times with claims made that were not justifiable. It became associated with the magical effect of "the laying on of hands," which was part of the developmental history of the healing arts.[2] For this reason and because of the dearth of precise information on its physiological effects, it is not surprising that a negative attitude toward massage persists.

In our hurry to discard that which defies analysis, let us not forget that man's observations and practical applications have most often preceded theory. The wheel and the axle were used long before it was determined that a circle has 360 degrees, or that mechanical advantage is equal to the radius of the wheel divided by the radius of the axle.

Review of Pain

The facts of observation and every day experience remain: massage relieves pain. How? To answer this question requires some knowledge of the entity that massage is to affect. Here again we have a difficult problem. Even a definition of pain is elusive; it appears to transcend the vocabulary. As observers we can not recognize pain; it can only be experienced. Since we tend to forget pain, even experience defies description. This is different from other kinds of sensory experience, such as smell, sight, hearing, or even touch, temperature, or pressure; what impinges on these sensory receptors can be experienced by other observers. It has only been within the last 100 years that investigators have become aware that pain is a specific sensory modality distinct from other sensations and is mediated through its own neural apparatus. That pain may be mediated through sensory receptors other than the free nerve endings of pain is refuted by the evidence to date.[3, 4]

Broadly classified, we have two kinds of pain: (1) cutaneous pain and (2) deep pain. Cutaneous pain is generally recognized as being of two types: (*a*) a fast, pricking, sharply localized pain and (*b*) a slow burning sensation, less sharply defined but fairly well localized pain. Deep pain on the other hand (the kind with which physical therapists are most often concerned) has a dull, aching or boring quality which is poorly localized. Deep pains characteristically spread and are felt in areas other than the site of the original pain. The spread may be by deep or superficial pathways or both. The spreading effect of deep pain is called referred pain. Deep pain may originate in the viscera and is conducted to the central nervous system via the afferent fibers of the autonomic nerves. The impulses of deep pain may also originate in muscles, tendons, joints and associated fascia; and for the most part they are conducted to the central nervous system by the muscular branches of the mixed nerves. This is called deep somatic pain.[3, 4, 5, 6, 7, 8, 9, 10]

The classic experiment of Lewis, in which he had a subject do repeated muscle contraction with the circulation of the forearm occluded, illustrates the point that ischemia is an important

factor in muscle pain. Lewis concluded that the stimulus for pain is a chemical substance arising out of the contraction process, which is stored up when the vessels are occluded. This he called factor P, and it is thought that of the many agents which may constitute this factor P (anoxia, *p*H changes, lactic acid, potassium, and histamine) potassium is the most important. Both activity and ischemia release potassium from the muscle fiber, and intra-arterial injection of potassium causes a severe pain in muscle resembling ischemic pain. Lewis further observed that pain will occur when the circulation is intact if the blood is not sufficiently oxygenated and that pain will occur also during sustained muscle contraction.[11] That sustained muscle contraction will cause pain is important to our understanding of use of massage for pain, because much discomfort and pain in organic disease, injury, and anxiety states result from it.[9] The cause of pain from sustained muscle contraction is undoubtedly due to a decreased blood flow because of the clamplike effect on the vessels within the muscle. Sustained muscle contraction leading to pain arises from a variety of reflexes resulting from pain stimuli from the viscera, skin, muscles, joints, tendons, and higher centers.

It is a common experience that sustained voluntary or involuntary contraction of the neck musculature which occurs while watching a poorly placed TV set, using a microscope, or driving for long distances gives rise to pain and stiffness in the neck and headache.

Simons et al.[8] have observed that pain produced experimentally in a restricted focus in the head area gives rise to a second more generalized pain: headache. These authors believe that this kind of headache is due to tension in the neck musculature. They found that procedures which increased the action potentials in the neck musculature increased the headache, and they inferred that sustained contraction of skeletal muscles of the head and neck is the source of this secondary pain. They also observed that the pain in the neck and the headache may outlast and even exceed the original cause of the pain.

Headache may arise from a variety of specific causes, but it may be enhanced by a secondary pain resulting from sustained reflex muscle contraction. Headache may also be due primarily to sustained reflex muscle contraction: from poor posture, sustained concentration as in prolonged use of the eyes, or emotional tension.

The precise nature of building up of reflex muscle contraction is not known. It may be a spread of excitation on the interneuron pool of the spinal cord.[3, 4, 6, 9] It is also suggested that neck muscle spasm may be analogous to the muscle spasm that occurs in response to injury, as in a fracture, and may represent a protective fixation.[8, 9, 10, 12] Simons[8] suggests that it may be symbolic of withdrawing the head from a harmful situation or of stabilizing the head on the shoulders for a charge against a threat. At any rate the sustained muscle contraction may be produced by a vicious cycle: deep pain → sustained reflex muscle contraction → deep pain → reflex muscle contraction.

Holmes and Wolff believe that in many instances the primary local cause of backache is minimal, but the muscle tension produced by anxiety and emotional distress which causes secondary pain in the back may outlast and exceed the primary pain.[4] Thus we see that pain or emotional stress may produce associated muscle tension, which produces a secondary pain due to ischemia.

Another mechanism may also operate: that of referred pain from muscle, joints, tendons, and associated fascia. Deep pain in a muscle, for example, may be referred to the dermatome supplied by the posterior root fibers which also supply the painful muscle. The areas of referred pain may in turn produce secondary pain as the result of sustained contraction in related muscles and again the vicious cycle: pain → sustained reflex muscle contraction → deep pain → reflex contraction.

Following acute injury to muscles, bones, and joints, trigger areas may be formed according to Travel, Bonica and others.[5, 10, 13] These are small, hypersensitive regions in muscles or connective tissues from which pain impulses travel to the central nervous system to produce referred pain. A prolonged bombardment of impulses from the trigger area produces tender areas and muscle spasm in the areas of reference. These trigger areas develop most commonly in areas of greatest mechanical stress: shoulder girdle, low back and neck.[5, 10, 13] The trigger areas within the muscle or associated deeper tissues are probably caused by minute areas of trauma connected with the stresses of daily living, chronic muscular strain, fatigue, chilling, infection, and psychogenic stress.[5]

THE ROLE OF MASSAGE

The therapeutic effect of massage in these pain syndromes is concerned with breaking the vicious cycle of pain: sustained reflex muscle contraction → deep pain → reflex contraction. Since the secondary pain of sustained muscle

contraction is the result of decreased circulation caused by pressure upon the vessels within the contracted muscle, the major role of massage is to improve the circulation. Massage involves stimulation of touch, pressure, and proprioceptive receptors of the skin and underlying tissues respectively. It also involves mechanical effects upon the superficial venous and lymphatic channels. Thus, the relief of pain by the use of massage is brought about through certain mechanical and reflex effects.

1. *Mechanical Effects:*

Since lymphatics are for the most part noncontractile, the movement of lymph must depend upon outside forces: contraction of muscles and pressure generated by filtration of fluid from the capillaries. Hence, immobility due to pain or paralysis seriously interferes with lymph drainage. Sustained muscle contraction leads to a decreased arterial supply to superficial structures since the skin is supplied by muscular branches of the arteries, probably causing an increased venous pressure which in turn causes an increased capillary pressure. With increased capillary pressure, the filtration of fluids from the capillaries into the extracellular spaces is effected. If the lymph drainage cannot cope with the increased transudation from the capillaries (as occurs in immobility) fluid collects in the extracellular spaces and gives rise to edema. The presence of edema and collection of metabolites provides for pressure and chemical stimulation of the free pain nerve endings, providing another source of pain. It should be further pointed out that prolonged accumulation of fluid in the extracellular spaces favors fibrosis and shortening of connective tissue elements. The pull on shortened fibrous tissues is quite painful and may provide another source of pain in various neuromuscular disorders.[7]

It is generally recognized that the mechanical pressures of massage are as effective in promoting lymph drainage, as the normal method provided by muscle contraction of ordinary activity.[11]

The mechanical effect of deep stroking on the superficial veins, in the direction of the venous flow, is easily observed in many persons. The displacement of fluid in a centripetal direction resulting in a decreased venous pressure provides a favorable situation for an increased arterial circulation. The capillary pressure is reduced and the potentiality for filtration into the extracellular spaces is decreased, thus the load on the lymphatics is also decreased and the possibility of fibrosis is diminished.

2. *Reflex Effects:*

The increased circulation by way of improved superficial venous and lymphatic flow is an effect of deep pressure produced by stroking or compression movements. Mechanical pressure from stroking movements probably also produces direct effects upon the capillaries resulting in capillary contraction as seen in the "white" reaction following mechanical stimulation of the skin. It is said to be of capillary origin and is not dependent upon nerves. According to the standard physiology texts, it may be a direct response of the capillaries to irritation or to some substance liberated as a result of the mechanical stimulus. With firmer pressure, a "red" reaction appears. This is the result of capillary dilatation and is not dependent upon nervous mechanisms. Stronger stimuli or repeated stimuli produce a "red flare" and is due to dilatation of the arteriole. It is thought that dilatation of the arteriole may be due to a local axon reflex mechanism.[14] With an intense stimulus (which is not considered a desirable massage procedure in this country) a wheal may be formed. This "triple response"—red reaction, red flare, and wheal formation is believed to be brought about by a diffusion of a substance liberated by the cells of the skin in response to mechanical stimulation. The substance bears a resemblance to histamine in its effects: capillary dilatation by its direct effects, arteriole dilatation by the axon reflex, and finally a wheal due to the increased capillary permeability and the release of fluid.

The existence of vasoconstrictor nerve fibers which increase the tone of the arterioles is unquestioned. Their cells of origin are located in the intermediolateral column of gray matter of the thoracic and upper lumbar cord and their fibers pass via the anterior roots to synapse in the chain ganglia via the white rami; they rejoin the segmental spinal nerves via the gray rami to be distributed to the vessels of the skin and muscles. The anatomy of the vasodilator fibers is confusing and debatable. The vasoconstrictor fibers are limited for the most part to the sympathetic system; the vasodilator fibers may not be restricted to the parasympathetic system as is often described. Barron suggests that vasodilator fibers are distributed not only via the parasympathetic outflow but they are also found co-mingled with the vasoconstrictor fibers of the sympathetic outflow.[11] Another group of vasodilator fibers are said to be intermingled with the afferents of the spinal nerves. At the periphery, an afferent fiber from a re-

ceptor in the skin may give off a collateral to the arteriole of the vascular bed of the skin. Thus, local stimulation of the skin sets up (in addition to the afferent impulses to the central nervous system) an axon reflex that acts upon the arterioles. That vasodilatation does follow experimentally produced antidromic stimulation (causing impulses to flow back to the receptor) of the dorsal root is generally accepted. The question that is debated, is whether impulses are normally set up in the central ends of the dorsal root afferents, for neural control of the blood vessels of the skin. Such an antidromic effect could explain the effects of massage; i.e., peripheral stimulation of the sensory afferents resulting in reflex dilatation of the arterioles of the muscles and vascular bed of the skin.

Bayliss has shown that stimulation of the sensory afferent nerves from the limbs in animals brings about vasodilatation due to inhibition of the local vasoconstrictors as well as excitation of the local vasodilators, an effect comparable to reciprocal innervation seen in skeletal muscle.[11] Thus the blood supply increased by the sensory stimulation of massage may be a combination of excitation of the vasodilators and inhibition of the vasoconstrictors.

Barron suggests that evidence is also accumulating which indicates that there are pressure sensitive fibers intermingled in other nerves of the blood vessels of the skin and viscera which if activated bring about a fall in blood pressure through vasodilatation of the splanchnic region.[11] He further states that stimulation of the sciatic or other mixed nerves by cooling, activation by weak stimuli or mechanical stimuli may cause vasodilation of the splanchnic area.[11] This might explain some of the visceral effects claimed by the advocates of Bindegewebsmassage which may be termed a weak stimulus.[15]

Deep pain following ischemia resulting from sustained muscle contraction may be relieved by massage through the improved circulation afforded (1) by the mechanical pressure on superficial venous and lymphatic channels and (2) by reflex dilatation through stimulation of the cutaneous afferents mediating touch and pressure. Another possibility for the relief of pain may be mediated through another mechanism. The stretch or tension, placed on the tendons and fascia surrounding the muscles during the stretching and compression movements, as in pétrissage, may have an inhibitory effect on sustained muscle contraction. It is a well known fact that a "cramped muscle" can be relaxed by stretching it or by deep kneading. Impulses from the tendon sensory organs (probably Golgi tendon organs) and perhaps also from the fascia and adjacent joint structures, which are activated by stretch, produce powerful central inhibition of the neurons controlling that muscle. This effect has been called the inverse myotatic reflex.[16] Relaxation and the relief of pain of sustained muscle contraction by massage and traction might possibly be explained on this basis.

3. *Psychological Aspects:*

Undoubtedly the psychological aspects of massage are quite important. In infancy, pain leads to crying and a response from the mother or loved one. The association of pain → crying → and comfort by a loved one (perhaps in the form of stroking of the fevered brow or massaging a bumped knee) and relief of pain, may be an aspect of the relief of pain afforded by therapeutic massage. The attention and concentration of effort provided by the physical therapist, and the fact that "something is being done" may have therapeutic implications. Recent evidence indicates that the perception associated with one type of sensory input is modified when there is another type or source of sensory input arriving at the same time and at the same level of the spinal cord.[17, 18, 19] For example, an increased sensory input transmitted through the larger myelinated nerve fibers, which mediate touch and pressure and proprioception (and stimulated by massage), might possibly mask sensory impulses arriving over the smaller nerve fibers such as those mediating painful perception. It is also possible that efferent impulses from the brain, acting through the reticular formation of the brain stem can produce inhibition of sensory inpulses as they arrive at receiving nuclei in the central nervous system. If a cat is subjected to constant clicking sounds, and is suddenly confronted with a mouse, the size of the action potentials produced by the clicks as recorded at the cat's cochlear nucleus suddenly decreases.[17] This may be part of the mechanism for the interaction of one type of sensory input and another. It might follow that when a person feels confident in the prescribed treatment and in the physical therapist a pattern of activity is set up in the forebrain which inhibits the relay of painful impulses as they enter the cord from the periphery. Probably the more important factor is that such confidence relieves the muscle tension of anxiety which contributes to pain. The importance of empathy is obvious—the innate compassion and liking for our fellowman becomes an important therapeutic weapon for the relief of pain.

"To take pains" in the skillful application of

massage requires attention to the task at hand and a thorough knowledge of the details of surface anatomy. It is surprising how little emphasis is placed upon the importance of surface anatomy in teaching many of the physical therapy procedures. Perhaps a return to some of the fundamentals is in order.

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*Pain and Exercise**

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Pain is as old as mankind itself and through all of recorded history it has received the attention and concern of both scientists and philosophers. Particularly in the past half-century, so much has been written about pain that it is difficult to know what is new, or what approach seems best to fill in the tremendous gaps in our knowledge. To discuss such a capricious sensation in relation to muscle and muscular activity (viz. exercise) is to discover how little concrete knowledge of pain we actually have. The literature on this topic is extensive, vague and confusing, and to the casual reader the experimental work is apt to appear inconsistent and misleading.

Pain is an experience which is complicated by many factors. Painful injuries received in the midst of battle or during a football game often go unnoticed. This may be not so much a lack of perception of the pain but rather a particular mental or emotional attitude toward the injury which prevents its integration into a higher cortical act. Thus, any discussion pertaining to the relief of pain by physical measures, and particularly to the relief of pain by such an empirical modality as exercise, must be tempered by an awareness that mental attitude alone can interrupt or enhance the perception of, and the response to, pain.

This paper must necessarily be limited to discussion of pain as a relatively simple sensation. But even so, it must be remembered that this disturbing symptom means much more than just an unpleasant sensation to the patient. Rather, pain presents itself as a highly variable symptom-complex which contains sensory, reflex, and emotional components.

Whole books have been written on the subject of pain as it is related to faulty posture and other biomechanical factors. Discussion of such subjects will be omitted here and pain elicited by mechanisms which are only partly mechanical in nature will be presented.

Discussion of the physiology of pain is a vulnerable and elusive topic because pain is such a personal, subjective phenomenon. Pain does not possess obvious sensory receptors such as those which subserve vision, touch, or proprio-

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ception and for this reason it is better to speak of pain "acceptors" rather than pain receptors.

Aristotle considered pain, like pleasure, to be a "passion of the soul." It is always expressed as an emotional response by the patient which may range from utter abjection to complete denial. A limerick expresses this ambiguity well:

> "There was a faith healer of Deal
> Who said: 'Although pain isn't real,
> If I sit on a pin
> And it punctures my skin
> I dislike what I fancy I feel.'" [1]

The majority of patients who complain of muscle pain describe this pain as deep and aching. Usually it is poorly localized. It is not generally appreciated by physical therapists that most skeletal muscle pain which constitutes a clinical problem is referred pain. Body movements which involve either a passive stretching or a strong active contraction may increase the muscle tension to the extent that a trigger point is mechanically stimulated and subsequently referred pain is experienced in a remote area. This diffuse pain from muscle might be explained by virtue of the pain fibers from muscle having diffuse rather than localized synaptic connections in the central nervous system.[2] Treatment of the site of the pain, therefore, may have no effect in alleviating the pain.

It then becomes essential to have some idea of the basic mechanisms of muscular pain in order to approach intelligently the problem of alleviating pain by physical therapy. There have been many attempts to explain the physiologic principles of muscular pain but we are dealing in the realm of hypothesis only. Further study is needed and the more we study, the more we discover our ignorance. Perhaps Sir William Hamilton had the right idea when he said: "The highest reach of human science, is the recognition of human ignorance." [3]

Mechanisms of Muscle Pain

There are at least two ways in which the topic of muscle pain may be approached. The first is the preexisting pain in muscle induced by a pathologic or mechanical factor and for which exercise is employed as a therapeutic agent. The second is the pain which may be induced or aggravated as a direct result of exercise.

Considering muscle pain generally for a moment, the question must be raised as to whether there is a specific stimulus for muscular pain.

Pain has always been associated with the idea of injury to tissue. But it has been shown that threshold pain can be induced where no injury has occurred.[4] It is also well recognized that the threshold for pain is lowered when tissue is merely placed under tension. A muscle cramp, which is precipitated by contracting an already shortened muscle, is a common example of this. The mechanism of the pain here is assumed to be the sustained contraction itself, perhaps causing prolonged pressure and impingement on the free nerve endings that subserve pain.[5, 6, 7]

We know, too, that prolonged muscular contraction leads to pain and tenderness. The mechanisms here are twofold: the pain may result from the central spread of hyperexcitatory effects induced by sustained noxious stimulation; [5, 6, 8] or the muscles themselves may be the source of pain through the accumulation of metabolites or of extracellular fluids (edema). We would expect, therefore, to find pain as a feature of disease conditions where the contraction of muscle is severe or prolonged. But it may be pointed out that the spasm of tetany is not necessarily painful, nor are the contractions of muscle in myotonia congenita and myotonic dystrophy painful.[11] It is, therefore, unwise to make any generalizations about muscular pain.

Another familiar form of muscle pain is that which follows a day of so after unaccustomed or unusual activity. The soreness and stiffness may come from one or a combination of factors:[9, 10] a general short-lived soreness due to the accumulation of metabolites after a fatiguing exercise; or deep aching due to injury within the substance of the muscle. Pain attributable in metabolites may be relieved by mild reciprocal exercise which will increase the blood flow to the part and remove the end products of muscle activity. In the other form of soreness the discomfort may be more persistent, probably due to the breaking up and reforming of serofibrinous adhesions between the muscle fibers. Slow gentle contractions may stretch out these adhesions and when further tearing is avoided, pain will be minimal. It is doubtful if these two types of soreness exist as exclusive alternatives. More probably, most muscle soreness following exercise and overexertion is a mixture of both mechanisms.

Muscle pain is also present in regions of inflammation. In such inflammatory diseases as dermatomyositis, there is a painful swelling of the muscles in the acute phase, although as the disease progresses pain is not a major symptom.[11] In other collagen diseases such as rheumatoid arthritis and scleroderma, the problem of pain is more complex than this discussion permits. In inflammatory states, the mechanism of pain is probably direct stimulation of pain acceptors by the chemical irritants that are a part of the inflammatory process.

Anterior poliomyelitis, a disease affecting the anterior horn cells, is also associated with muscle pain. The picture here is complex because there are both central and meningeal components to consider, but muscle pain and aching is an explicit trait in the early stages of the disease. In the later stages pain is common due to stretch of tightly contracted tissues and to overwork of weakened muscles.

MUSCLE SPASM

Traumatic conditions of muscle are quite painful as a rule, and reflex spasm is a feature of most muscle trauma. The concept of muscle spasm, however, and the term spasm, is one which has been widely used to represent many different conditions. In order to resolve the question of what is spasm, it is necessary to examine the physiologic mechanisms in both normal and abnormal muscle tone.

Muscle spasm is frequently considered to be an exaggeration of normal muscle tone. This question has been the subject of considerable controversy in the literature in that some authors, notably Ralston and Libet,[12] report that in normal tonus in man, electrical activity is entirely absent. Others, notably Joseph[13] and Granit,[14] claim the electrical activity is clearly present.

If muscle spasm is defined as a reversible state of sustained involuntary activity accompanied by muscle shortening,[15] the argument may be resolved into two factors. It is reasoned that since muscle spasm necessarily represents activity of the contractile elements of the muscle, this activity could be aroused from either a neurogenic, or less probably, from a myogenic source.

To consider first the neurogenic basis for muscle spasm: it may well be that in man tonic electrical activity is difficult to detect, particularly if the output is small and persistent.[14] In order to describe tonic activity, attention must be focused upon the integrated neuromuscular control system including the muscle spindle, the small motor nerves (gamma system), the motor neurons of the ventral horn, and the inhibitory pathways which arise in muscle tendon. (Fig. 1)

There is general agreement that under physiologic conditions, contractions of skeletal muscle are brought about by discharges of impulses from the ventral horn alpha motor neurons over the final common pathway. In recent papers by Granit[14, 16, 17] it would appear that our whole concept of muscle tone in man is being brought closer to the demonstrated situation in invertebrates. Evidence is accumulating for the existence of two varieties of alpha ventral horn cells: the tonic type specialized to give the prolonged repetitive discharges that subserve slow, maintained contractions; and the phasic type specialized to give brief bursts of discharge subserving quick contractions.[16, 17] Early experiments by Denny-Brown[18] led to speculation that the tonic and phasic motor neurons predominantly innervate slow acting red muscles and fast acting pale muscles respectively; however, all muscles would have both tonic and phasic motor neurons as well as transitional types.[19, 20] It is also questionable whether any muscle can be exclusively considered either red or white, most being mixtures.

There is a third system of motor neurons involved in this concept of motor control, the gamma system. In the normal state this small motor system is always active and is responsible for maintaining the ventral horn cells in a facilitated state ideal for initiating postural adjustments.[14, 21, 22]

It might be incorrect to state that the gamma system deals only with postural adjustments, and it can be postulated here that a high state of tonic gamma activity is one of the underlying mechanisms for muscle spasm. Every site in the brain from which motor activity can either be coordinated or inhibited is also capable of initiating or inhibiting gamma activity.[23] It is not outside of the realm of speculation, therefore, to hypothesize that the thalamic pain mechanism with its cortical and other association pathways could excite the gamma system through vestibular, reticular, or cerebellar routes, and thereby initiate muscle spasm.

The proprioceptive end of this control system is of particular interest in the problem of muscle spasm. Gamma excitation sensitizes the neuromuscular system to stretch and without it there is very little sensitivity. Impulses over the gamma system set up tension in the intrafusal fibers of the muscle spindle which in turn increase the discharge from the spindle afferent and consequently the efferent discharge from the alpha motor neurons. Under normal conditions, the frequency and intensity of the spindle afferent discharge is kept in check by tension-sensitive inhibitory reflexes from the Golgi tendon organs. These inhibitory impulses normally prevent the spindle discharge from becoming excessive, definitely by alpha motor neuron inhibition and possibly by gamma motor neuron inhibition, particularly when the muscle is greatly extended or stretched.

This inhibition from Golgi tendon organs and other endings sensitive to tension need not be

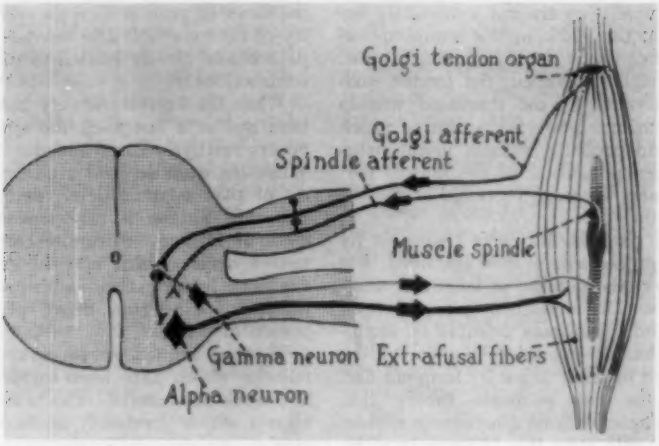

Figure 1. Schematic diagram of integrated neuromuscular control system showing afferent and efferent pathways.

present. In many cases of muscle spasm the inhibitory circuit is probably not active because the tendon attachments are not adequately stretched. This is an assumption which is made on the basis of the fact that joint rotation occurs which may preclude much tendon stretching.

Another possibility which might explain the absence of inhibition in muscles in spasm would be an adaptation process on the part of the Golgi tendon organs. If such is the case, the receptor threshold would become elevated under conditions of continued shortening and, therefore, a much greater stretch would be needed to activate them.

These speculations bring us to a point where a plausible explanation can be tendered for the effect of certain exercise procedures on muscle spasm. It has been observed and reported by Knott and Voss[24] that greater relaxation of a shortened, painful muscle is obtained when the patient performs an active maximum contraction against resistance, than when the part is passively stretched. These are the "hold-relax" and "slow-reversal-hold-relax" patterns described in their book.

As described, the procedure involves an isometric contraction against maximal resistance, and this is held for a time. Several active contractions are followed by relaxation at which time the physical therapist gently increases the range of motion, or the patient is instructed to do so actively. This pattern is repeated many times and at frequent intervals. Empirical evidence points to the fact that pliability of the muscle is increased following this procedure and that pain and reflex splinting are minimal or abolished.

Every physical therapist is aware of the reflex pain and splinting that occurs when a tight muscle is passively stretched. These effects emanate largely from the fact that the patient is not cooperating and, in fact, is opposing the external force because of fear of the pain which is inevitably produced.

The observed differences in the extensibility of actively and passively stretched muscle are due to specific nervous system factors. On the neural substratum, the muscle spindles are activated when passive stretch is applied; but in spasm, the intrafusal fibers of the spindle are quite likely already biased by tonic gamma activity that probably constitutes the origin of the spasm.

Such additional activation of the spindles by passive stretch would bring about a strong resistance to stretch via the stretch reflex arc. If the tendinous attachments were not stretched previously, the passive stretch will merely take up the slack and will not cause the firing of the inhibitory impulses from the Golgi tendon organs. The rise of tension which ensues gives rise to greater pain and a positive feed-back mechanism is set up whereby the stretch begets tension, which leads to pain, which leads to still greater tension . . . a self-propagating vicious cycle.

Now if, as proposed by Knott and Voss, the

muscle is maximally contracted voluntarily before the stretch, the slack in the tendinous attachments is taken up by the contraction process. Then when stretch is applied, the tendon end-organs are activated by the increased tension and they fire causing a powerful inhibition which affects alpha and probably gamma motor neurons. This causes relaxation of the muscle permitting subsequent increase in range of motion and relief of pain.

The relief of pain during early treatment by these exercise procedures is not sustained, but the pain-free periods increase in length as treatment progresses. The continued and prolonged relief of pain and spasm may possibly be attributed to a post-tetanic potentiation effect of the inhibition circuit brought about by frequent use.

Concerning the less probable theory that muscle spasm may arise from a myogenic source, this author can only state that if such were the case, spasm would be expected to persist following denervation. Since spasm disappears when a muscle is denervated there is little likelihood that a myogenic theory is tenable.

CONTRACTURE

If muscle spasm continues over a long period of time, it can result in contracture. To distinguish the condition from spasm, contracture has frequently been defined as a permanent, irreversible shortening of muscle. Such muscles tighten abruptly when they are stretched and resist further attempts to lengthen them. Unless the contracture process is reversed early, the immobilization will reach a point where pain no longer occurs until movement is attempted. The pain in this situation, of course, is due to stretch of the tightly contracted tissues. As in muscle spasm, active rather than passive exercise will produce optimal results without setting off a pain-spasm cycle.

EXERCISE AND ISCHEMIA

Another common source of muscle pain is that which arises from muscles deprived of adequate blood supply. It is generally accepted that the arteries of a healthy extremity not only can supply the resting needs of the limb, but can easily carry the extra blood required by exercising muscle.

During and following light exercise when only a mild oxygen debt is incurred, pain is not usually experienced. If, however, muscular contractions are sustained or prolonged, pain and tenderness can occur even in normal extremities. The time interval between the start of the exercise and the onset of pain is directly related to the severity of the exercise. The intensity of the induced pain is also closely related to the strength of the contractions.[25]

When the exercise is very heavy, i.e., a heavy load and/or a fast pace, the appearance of pain occurs relatively early and the intensity is high. When the exercise is of a milder nature, the onset of pain is much later, perhaps not appearing until fatigue is experienced. The development of fatigue as exercise continues is a protective device which may be construed as preventing a heavy exercise with its concurrent high intensity pain from being prolonged over a period of time.

There is a quick disappearance of pain when muscles which have been involved in heavy active work are relaxed. The tenderness of hyperalgesia which invariably accompanies pain may persist, however, after the pain has subsided.[25]

The mechanisms responsible for the pain which is found in actively working muscle are related principally to the functional capacity of the circulatory system. During active contraction the mechanical impingement of the muscles on the supplying blood vessels reduces the blood flow and thus creates a state of relative ischemia in the muscle which persists for as long as the contraction is maintained.[26, 27, 28] The degree of ischemia is somewhat proportional to the strength of the contraction. The increases in blood flow which are observed following exercise are also proportional to the amount of work done.[28]

The increases in blood flow that accompany dynamically working muscle occur during periods of relaxation; that is, between contractions.[27, 28] Thus, depending upon whether the exercise is isotonic or isometric, upon the duration of the exercise and upon its intensity, such muscle may be relatively ischemic over a long period of time.

When a muscle works under anaerobic or near-anaerobic conditions, changes occur which permit a shift of electrolytes across cell membranes and for the accumulation of metabolites within the muscle. Metabolites are a source of pain, and are normally prevented from amassing in the muscle by an adequate blood flow which rapidly disperses them.

Lewis[29] theorized that the pain in ischemic muscles was brought about by the presence in the extracellular fluids of a metabolite which he named "Factor P." Among chemical agents which have been suggested to be Factor P are: histamine,[29, 30] acetylcholine[31] and potassium.[32, 33]

Potassium has received the most support as the substance acting on the pain acceptors par-

tially because this ion is predominantly intracellular and is therefore released with tissue destruction; and partly because intra-arterial injection of potassium excites severe pain. Benjamin[33] has presented evidence more recently indicating that reversal or inhibition of cellular release of potassium tends to inhibit pain sensation. MacMillan[34] has shown that histamine is released from tissue cells under the same conditions as potassium, and that histamine may actually increase the potassium release. Histamine is not essential to the production of pain, however, and its effect, if any, must be indirect.

We have now mentioned two distinct mechanisms for muscular pain, one being the result of direct stimulation of the pain acceptors and the other more indirect due to the release of a substance, most probably potassium, caused by the reaction of tissue to a noxious stimulus.

In view of the considerations on the relationship between prolonged contraction and muscular pain, it would seem that the spacing and duration of rest periods during exercise are important factors in muscle economy. The muscle is provided with energy via aerobic chemical processes for only a brief period before anaerobic reactions take over. In order to provide a prolonged supply of aerobic energy there must be sufficient blood flow to insure proper oxygenation of the tissues. Frequent rest pauses in the exercise or work program will assist toward this end. Prolonged heavy exercise, isometric exercise, and exercise with few or no rest pauses will be expensive in terms of early onset of fatigue and muscle pain.

The scope of this paper permits only a few brief comments about the ischemic muscle in peripheral vascular diseases. Unlike pain arising from other systemic diseases, pain in peripheral vascular disease rarely relates to the vascular components. Pain is produced, however, by a reduction in blood flow to an extremity, occasionally by reflex mechanisms secondary to the interference, or by inflammation of adjacent structures. The type of pain may be intermittent claudication associated with exercising muscles, or it may be rest-pain associated with anoxic conditions.

The pain of claudication, the characteristic symptom of arterial occlusion, is the manifestation of mild ischemia which appears in limbs which are exercising lightly. The site of the pain will usually appear first in the small muscles of the foot and later in the calf. Thigh claudication is rare. The muscles which are most active in the ischemic area will be most affected. For example, obstruction of the popliteal artery causes calf claudication while occlusion of the common iliac artery which reduces flow in the hypogastric vessels causes gluteal fatigue on walking.[35] When thigh claudication occurs it is usually described by the patient as aching or fatigue rather than as a cramp or sharp pain.

Intermittent claudication in the lower limb is experienced after walking and rarely exists when the patient is merely standing except in well advanced stages of the disease. Almost instant relief of the pain will be experienced if the patient will stop walking and stand still when the symptoms of pain appear. If the patient continues to exercise beyond the onset of pain, the recovery period may be prolonged accordingly. Pain which lasts for hours after exercise does not point toward vascular insufficiency as the cause of the pain.[30]

The amount of exercise or the load of the exercise governs the onset and degree of severity of the claudication. If the patient increases the load of the exercise, or the pace, the functional capacity of the already impaired circulatory system will be reached sooner and symptoms of distress and pain will appear earlier and be more severe. Reduction of the exercise stress imposed will, of course, result in the converse being true; that is, more work can be accomplished before pain interferes.

As the progress of the disease continues and as the degree of ischemia increases due to the formation of multiple obstructions in the vessels and a concurrent diminution of the collateral supply, a pain may appear which is deep and burning and which does not regress with rest. In such cases the patient gets only partial relief by dangling his legs in various positions.

In recent studies by Winsor[37] on arteriosclerotic patients, it was shown that exercise of the gastrocnemius-soleus muscles caused an increased blood flow through the calf muscles, but a diversion of blood flow away from the ankle, foot, and toes. It would thus seem detrimental to the distal portions of the limbs for patients with obliterative arterial disease to walk excessively or to exercise to a point where a blood flow debt is incurred.

Intermittent claudication in the upper extremities is found much less frequently. Heavy resistance exercises, however, may result in the typical symptoms of intermittent claudication.

PAIN AND MOTOR PERFORMANCE

Another facet of the relationship between pain and exercise is the effect pain may have on motor performance.

It is well documented that voluntary move-

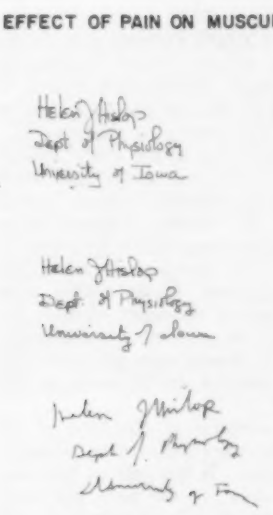

Figure 2. The effects of ischemia and muscle pain on the coordination of a voluntary movement. Top: normal handwriting. Center: following three minutes of circulatory occlusion with a blood pressure cuff (cuff still in place). Lower: during severe pain induced by alternately flexing and extending the fingers of the ischemic arm.

ments are greatly influenced by afferent impulses, the concept that sensory input regulates motor outflow. The best example of this would be the utter uselessness of a limb which has lost its sensory innervation in spite of an intact motor supply. Moreover, distinct effects may be exerted on the cerebral cortex not only when the normal afferent impulses are absent, but also when they are increased either in frequency or intensity.

By this token, muscle pain can produce changes in the reactivity of the motor function of the cortex so as to cause disturbances in muscular coordination. Gellhorn[38] demonstrated this fact in a simple experiment. An inflatable cuff was placed around the arm of subjects so as to produce an ischemia. Three minutes after the circulation had been occluded, a handwriting test was performed and compared with a control sample of handwriting to determine the effects of ischemia on hand coordination. Following this test, the fingers were flexed with the blood flow still cut off until a diffuse, intolerable pain was produced. Then while the pain still persisted the handwriting test was repeated. Ischemia alone had no visible effect on the handwriting. However, the muscle pain initiated by exercising ischemic muscle caused a profound alteration in writing, the words becoming almost unintelligible. The experiment was repeated by this author and the results are shown in figure 2.

It might be stated that pain stimuli arising in muscle can modify both qualitatively and quantitatively the performance of movements. The increased afferent discharge from muscle affecting the excitability of the central nervous system is responsible for these effects.

The modifying influence of pain on reflex movement has received considerable attention. Pain induced by exercising an ischemic muscle abolishes the tendon reflex whereas the reflex remains unchanged with ischemia alone.[38]

In other interesting experiments[39] patients with lesions of the cerebral hemispheres with associated pyramidal tract defects were subjected to thermal stimuli of varying painful intensities. As would be expected, the intensity required to evoke reflex movements varied from patient to patient and in the same patient from time to time. In contrast to the reflex movement threshold, the pain threshold remained constant. In the resting condition and with no previous noxious stimulation, the pain threshold in these patients was always elicited before the reflex movement threshold. If, however, the painful stimulus was repeated frequently, the threshold for reflex movement lowered and was evoked before actual pain was perceived. This evidence again points to the fact that the state of central excitation can be changed by volleys of afferent impulses arising from pain stimuli. What once may have been a nonpainful stimulus could, with repeated application, become adequate to evoke a motor response.

There appears to be some evidence that the flexor spasms in paraplegics are more frequent and more severe when there is a lesion that maintains a continuous bombardment of the central nervous system with afferent noxious stimuli.[39] These noxious stimuli might arise from such sources as bladder infections, decubiti, or pressure areas. There does not seem to be any evidence for the existence of similar effects in hemiplegia patients.

IMPLICATIONS FOR THE PHYSICAL THERAPIST

These observations of the effect of pain on the excitability of the central nervous system have considerable implication for the physical therapist in planning and executing any exercise program for persons with chronic or intense pain. The degree of interference with muscular co-

ordination increases as the intensity of the pain increases, and also with the degree of refinement of the task to be performed. Pain might have no deleterious effect on simple gross tasks but where precision, steadiness, and circumspection are requisites, even a low intensity pain can show a highly significant degree of interference.

Where pain has been related to work output[40] it seems that the total amount of work is not altered by simultaneous pain, but the efficiency of performing the work is markedly decreased.

The importance of the fear of pain, anxiety, and mental tension is apparent to all physical therapists. All of these conditions lead to a physiological demonstration of muscle overactivity. Anxious patients also show greater increases in tension under stress situations than do their healthy counterparts. Consequently, in a therapeutic situation from which some degree of pain experience is anticipated, the fearful, tense patient will experience widespread increase in muscle tension and pain. There will be a tendency for the increase in muscle activity to be more manifest in some muscle groups than others and the area involved is most likely to be the site of the presenting complaint. For example, the patient with a low back syndrome, when in a stress situation, will complain of greater or more intense pain and discomfort in that region.

Apprehensiveness, fear, and anxiety can materially build up tension, spasm and pain . . . again a self-perpetuating cycle which only adds to the total disability incurred by the disease or injury.

The most important role of the physical therapist is to gain the cooperation and confidence of his patient. When this is assured, the exercise program can proceed with a minimum of difficulty and delay. Securing the trust and confidence of the patient is the art of physical therapy, without which the science of treatment cannot be successful.

The apprehensive patient will be most fearful of any procedure which he thinks will inflict pain, and his tension will only rise higher if he does not understand the purpose behind an exercise program. Discuss with the patient in simple terms just what the exercise is and what it will do to relieve the condition. Do not fail, however, to convey the idea to the patient that a great deal of the responsibility for the success of the exercise program will rest with him and on his ability to cooperate in carrying out instructions.

The conquest of pain remains our greatest challenge. Our knowledge of pain is incomplete and imperfect. If some of what has been said here is speculative and conjecture, it has been said in an attempt to tie together many loose fragments into a meaningful picture. Justification may be attributed to the fact that our knowledge is changing so fast these days that a person could not stay wrong all the time if he tried.

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*Heat for the Relief of Pain**

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If the beneficial effects of a therapeutic agent for the relief of pain can be evaluated in terms of the number of years of use or its frequency of application, heat should be considered one of the best physical agents for this purpose. The most frequent reason for applying heat is to relieve pain, and its use is almost instinctive. As evidence of this, few people would refrain from warming painfully cold hands in front of an available fire. Throughout the history of men there has been and still is a fairly widespread belief that heat will diminish pain, but just how and why it does so is not well understood. On the other hand, the physical therapist is well aware that under certain circumstances heat may have just the opposite effect.

In physical therapy a number of "comfortable simplifications" are used to explain the physiological effects of heat. It is said that it increases circulation, relaxes muscles, reduces edema, and relieves pain. These simplifications can be likened to the one made by the bass viol player, John, whom Wendall Johnson mentions in his book, *People in Quandaries*. John played the bass viol. But he didn't play it the way other people play a bass viol. His bass viol had only one string, and he kept his finger always in the same place while he bowed that one string. In this way he played along, day after day—until his wife became exasperated, gentle soul though she was. "John," she said, "why don't you play the bass viol the way other people do? Haven't you noticed that they have many strings on their bass viols, and they move their fingers up and down all the time when they play?" "Sure they do," said John, as he went on bowing, "they're looking for the place. I've found it."[1]

Studying heat and pain might be compared to John's attempt—if he had the courage—to use more than one string. In the beginning this study may cause considerable disharmony of thought, but at the same time it *may* result in better use of the object being studied.

Heat as a Counterirritant

It has been suggested that heat is a counterirritant and this is the reason for its analgesic effect. A counterirritant is defined as a superficial irritant that is intended to relieve some other irritant. The exact reason for the effectiveness of counterirritation is not well understood. It perhaps can be explained by the interaction of two impulses which arrive in the central nervous system at the same time. Libet[2] points out that sensory impulses arriving in one size or type nerve fiber may modify the quality and intensity of another sensory modality mediated simultaneously by another size or type of fiber through interaction in the central nervous system. Fischer and Solomon[3] support the theory of counterirritation by implying that the soothing effect of heat

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may be only a central interference in the reception of pain impulses caused by impulses arriving from the skin thermoreceptors. In reporting a study on pain, Wolff and Wolf [4] observe that the intensity of deep pains can be reduced by nonnoxious thermal stimuli applied to the skin. They explained the efficacy of the hot water bottle for various painful conditions in this way.

In 1941, Gammon and Starr [5] did an extensive study on the relief of pain by the use of counterirritation. Part of the research done by these authors included the application of various physical agents as counterirritants following the subcutaneous injection of sodium chloride to produce deep pain. Heat and cold were among the agents tested. Of those counterirritants studied, heat ranked third in effectiveness for the abolition of pain. However, their studies showed that the surface temperature did not have a direct relationship to the intensity of this type of pain. Both heat and cold were effective. Whatever counterirritant was used, a temporary relief occurred immediately upon its application and then again after it was removed. Some of the authors' conclusions relative to the use of counterirritants for the relief of pain may have some clinical implications in the technic of application of heat for this purpose. For example, they found that to be *most* effective in relieving pain a counterirritant—

1. Should be of an intensity just slightly less than that which produces manifest discomfort when applied to the normal skin. (The optimum temperature for heat approximated 104 degrees F.);
2. Should be applied over the site of origin of the painful stimulus;
3. Should be applied periodically rather than constantly. (A frequency of about 5 minutes on and 10 minutes off was most effective inasmuch as there was a temporary relief of pain following the application and again after its removal.)

Heat and Increased Blood Flow

One of the most common simplifications of the effects of heat in the relief of pain is that heat increases blood flow. Even though this statement is undoubtedly true, the scientific use of heat to diminish pain through increased blood flow to a particular part will require a much more complete knowledge of mechanisms controlling the circulatory system than is now available. The circulatory system functions as a complex, integrated unit which uses nervous, chemical, and hormonal mechanisms to regulate blood flow to the various body organs. It is well to remember that the effect of external application of heat to the patient in physical therapy is not solely dependent on a particular type of heating device or the method of application. The exact circulatory adjustment of the body in response to the heat will be effected by the general circulatory requirements of the *entire* body.

Assuming that it is possible to increase directly or indirectly the blood flow to an ischemic part, the beneficial effect of heat on ischemic pain can be explained by increased circulation.[3] An augmented blood flow will increase the supply of oxygen, thus tending to lessen anoxic pain and reduce the accumulation of excess fluid or edema.[6]

It is interesting to note that a number of the conditions which are treated in physical therapy by heat are thought to be caused by ischemia. The pain associated with herniated intervertebral disks may be due to a compression which reduces blood flow through the nerve. Keele[7] states that ischemia of nerves increases their irritability.

Ischemic pain often results from diseases of the peripheral vascular system. Bouman [8] points out that heat must be used judiciously when this is the cause of ischemic pain. Heat applied in the presence of an artery that cannot dilate will only increase local metabolism and overtax a circulation that cannot increase. Burns might be the subsequent result and would increase pain!

Heat as an Equalizer of the Thermal Gradient

In 1947, Wells [9] proposed a most interesting theory as to why pain is relieved by heat. He suggested that it may not be the heating per se which stops pain but rather the equalization of superficial and deep tissue temperatures. Wells's article is cited frequently in the literature when the subject of heat for the relief of pain is mentioned. For a thorough understanding of his theory, it becomes necessary to define briefly what is meant by the term "thermal gradient."

What is called body temperature, usually measured as mouth or rectal temperature, represents only the temperature of the "core" of the body. The "shell" of the body has a much lower mean temperature than does the core, and there exists a temperature gradient from the core temperature down to skin temperature. For example, core temperature may be 98.6 degrees F., and skin temperature 92 degrees F., a total gradient of 6.6 degrees F. Of course, variations take place in the temperature gradient between core and skin due to environmental influences.[3] Keeping this information in mind, the proposal that tem-

perature equalization of superficial and deep tissue temperatures relieves pain, may be easier to understand.

A brief description of some of the experiments which Wells [9] performed on himself will serve to elucidate his theory. He attached an artery clamp to the web of one of his fingers. This produced a moderate pain in the area pinched by the clamp. He then stopped blood flow in his arm by inflation of a blood pressure cuff, and found that warming the *hand and clamp* in air or water lessened or even abolished the pain, in spite of the lack of blood flow. He then assumed that increased blood flow could not account for the diminished pain. Further experiments indicated that the optimum temperature for relief of pain by heating was approximately that of the blood and deep tissues. Warming the hand by means of a heat lamp failed to relieve the pain if the clamp and clamped tissue were maintained at the initial skin temperature; however, if the hand was maintained at the original skin temperature but the end of the clamp dipped in water 98 degrees to 102 degrees F. (approximately "core" temperature), pain was relieved. If he warmed the clamp above 102 degrees F., pain returned. This evidence indicated that the effects of heat were local and direct, and seemed to depend on the steepness of the thermal gradient between superficial and deep structures. Actually, Wells found no one optimum temperature for the relief of pain but rather that it was relieved only when the temperature was equalized. Heating the normally cooler skin to the temperature of deep structures and cooling the deep tissues to the temperature of the surface were equally effective. Pain of injury was aggravated or made manifest by the presence of a gradient when the injury by itself did not arouse pain.

Wells applied his experimental findings to clinical practice by stating that it was highly probable that pain originating from fascia, joints, and skin would respond like the experimental pain. For heat treatments to conditions involving the structures just mentioned he suggested that:

1. A few seconds of warming would give optimum relief from pain.
2. Heating above 102 degrees F. would be detrimental.
3. Long lasting relief would perhaps best be achieved by applying a special covering of high insulating value over affected parts to maintain temperature equalization and to prevent rapid surface cooling from sweating or cold air.
4. Exercises to increase joint motion should be carried out during the heat treatment when the temperature was equalized, rather than following the treatment.

Wells's proposal has a number of clinical implications relative to the technic of heat therapy. However, much of the pain that is treated by physical therapy is muscle pain, and he stated that his theory had no present application to this type of pain.

HEAT AS A RELAXANT OF SKELETAL MUSCLE

A well known effect of heat is its ability to relax skeletal muscle, especially the "spasm" or reflex contracture seen in poliomyelitis, in low back pain, or in rheumatoid arthritis. Fischer and Solomon [3] write that the exact mechanism by which heat relaxes muscle spasm is not clearly understood, but may possibly be due to the reflex effect of heat on central proprioceptor mechanisms, or *perhaps* the direct effect of heat on the muscle spindle. Hines and Randall [6] explain the pain caused by muscle spasm as being mechanical in nature. When a muscle remains in strong tetanic contraction or "spasm," the contracted muscle fibers impede the flow of blood through the muscle tissue, resulting in pain and tenderness from ischemia. Heat, by bringing about a change in the state of tonus of the muscle, influences blood flow by changing the intramuscular tension and releasing the "squeezed" blood vessels. Heat is frequently used to break up a pain-spasm-pain cycle by relaxing the muscle spasm developed originally as a protective mechanism, but that remained contracted to become the cause of the pain.

HEAT AS RELATED TO THE PAIN REACTION

Wolff and Wolf [10] have pointed out that there is a difference between the threshold for the perception of pain and the threshold for reaction to pain. Pain perception depends upon the intactness of relatively simple and primitive nerve connections. Reactions to pain, on the other hand, depend in part upon what the sensation means to the person in the light of his past experience. Pain perception is remarkably constant for all persons; but pain reaction, as one would expect, is extremely variable and depends upon climate, age, health, temperament, and many other factors. Blasko,[11] in this regard, says that the therapy being applied to the patient may depend upon the patient's mental attitude. The psychological meaning of "heat" to the patient may be as important as the physiological effect. (One might expect that a patient who has experienced severe burns probably has some question as to the bene-

ficial effects of heat.) Kelly,[12] in discussing the use of heat in psychiatry, suggests that continuous baths and wet packs lessen tension and induce sleep because they give the patient a sense of security. Lying in a tub of water or in an enclosed pack produces a feeling of warmth not unlike that experienced in infancy.

Those who have used heat in physical therapy are aware that frequently the attitude of the therapist will help to determine the particular meaning of the therapy to the patient and thus have a definite bearing on his pain reaction. A comprehension of the psychologic implications of heat to the patient and the significance of the therapist-patient relationship may provide means for more effective relief of pain with this agent.

HEAT PRESCRIPTION FOR THE RELIEF OF PAIN

Because heat alone is seldom, if ever, the *cure* for any disease or dysfunction, it must not be used until a diagnosis is well established. Some serious condition may be masked because heat prevented the pain receptors from performing their task of signaling impending or beginning damage. For this reason and because it can be harmful under certain circumstances, heat must be used judiciously.

Schliephake[13] points out that, although the physician is reluctant to appreciate or admit it, most prescriptions for therapeutic heat are empiric in relation to type, intensity, duration, and frequency. The selection of a heating device is often a matter of personal preference, and dosage is frequently a matter of economics, depending upon the convenience of the clinic, the patient, or both.

Among the first factors that are considered by the physician when he prescribes heat for pain are those relative to the patient. He attempts to find out—

1. The cause and type of pain,
2. The location of the pain,
3. The effects of heat on the pathological condition to be treated,
4. The adequacy of the peripheral circulation,
5. The general physical condition of the patient,
6. The patient's attitude toward treatment,
7. The response of the patient to previous heat treatments, if applicable.

The selection of the type of heat or heating device used may be based on any of the following factors:

1. The depth of penetration desired,
2. The area or areas to be treated,
3. Availability of the source,
4. Economic considerations,
5. Reflex response to heat,
6. Necessity for movement during treatment,
7. Physician's preference,
8. Patient's desire.

Relative to dosage Coyne[14] states that the patient's subjective analysis of the effects of the heat, and comfort are the rules of thumb. Schliephake[13] makes a few general suggestions relative to dosage:

1. Heat should be applied in smaller doses in acute processes than in chronic conditions.
2. Acute conditions often require more frequent application than do chronic conditions.
3. Heat is *usually* given for one-half hour. The physician should determine the proper duration by relief of symptoms.
4. A home program is desirable if it becomes necessary to continue applications of heat for more than a two month period.

SUPERFICIAL AND DEEP HEAT

The depth of penetration of heat energy produced by using various heating methods and devices has been the subject of numerous studies. Schwan[15] explains that the depth of penetration does not mean that at a certain point the energy is suddenly completely absorbed and transformed into heat. There is a rather smooth decrease of intensity. The successful use of any form of wave therapy should be based on an absorption sufficiently low to permit the radiation to reach the deep tissue; however, it must not be so low that it would penetrate completely through the body tissue with insufficient absorption. In biophysics, depth of penetration is that depth where the intensity is reduced to 50 per cent of incident radiation.[16]

The temperature rise in any matter can be brought about in two ways: (1) the temperature of a distant readily accessible surface is kept high, and due to heat *conduction* the part of interest is elevated in temperature; (2) heat may be developed in the part directly. In the latter method physical energy is conducted to the tissue to be heated and transformed there into heat.[15]

Superficial heating is usually obtained by the conductive method. Because tolerance of the body to surface application of heat is limited, superficial heating devices such as hot packs and infrared lamps, as used in physical therapy, do not cause an increase in temperature beyond a depth of about 1 centimeter. The effects of heat energy absorbed near the surface of the body may result from neural or chemical mechanisms rather than from a temperature rise in some specific body tissue or organ.[16]

Deep heating of tissues may be obtained by

short wave, by microwave diathermy, and by ultrasound. Heating by short wave diathermy is largely dependent on the electrical conductance of the tissues. Penetration with short wave can be expected to be about 5 cm. or 2 inches.[17] Microwave may also penetrate up to 2 inches, but this distance is highly variable and depends upon the extent of the fatty layer and the heat exchange in the tissues.[14] It is possible to elevate the temperature of muscle tissue with deep heating technic, but any increase in muscle temperature elevates bloodflow much less than a comparable rise in skin temperature increases skin blood flow.[3] Schwan [15] states that since clinical results indicate the usefulness of various forms of diathermy, the demand for deep heating devices is justified, even though little is known about the physiological and biochemical reactions caused by the various forms of physical energy employed for deep heating.

Local and General Heat

A complete discussion of the effects of local versus general heating would require a separate study, considering the complexity of the mechanisms involved. In physical therapy, however, heating devices are employed that treat the whole body as well as various local areas, and some understanding of the differences involved is essential.

If a large surface area of the body is heated slowly in a Moistaire cabinet, Hubbard tank, cabinet bath, or some other similar heating device, it is probable that a generalized response of heat dissipating mechanisms will result. These include transitory decrease in blood pressure, and increase in pulse rate, respiration, perspiration, and circulation. Muscles will relax and the heat will have a general sedative effect. The body uses all of its complicated regulatory mechanisms in an attempt to maintain its constant body temperature.

Many of the body's responses to local heat are brought about by the same mechanisms involved in temperature regulation. An understanding of temperature regulation gives insight into the reason for some of the remote effects which occur as a result of local heat to certain body parts. Local heat, as applied in physical therapy, does not significantly alter body temperature; therefore, the influence on the temperature regulating center in the brain is considerably less than when general heat is applied. If a small area is heated, blood flow increases. Heat may be transported from the core to the heated area because of the increased blood flow. The thermal gradient is decreased. As soon as the skin temperature increases above the core temperature, heat is distributed by the blood throughout the body.[3]

Moist and Dry Heat

In the treatment of some specific diseases, statements are made that moist heat seems to be more effective than dry heat—for example in the acute stage of poliomyelitis. Sweeney and Stoner[18] found that hot packs did elevate skin, subcutaneous and deep muscle temperatures, and produced vasodilatation; however, in a closing discussion Sweeney implied that it did not make any difference what type of heat was used. He quoted another physician who made the statement that "Heat is heat and it doesn't matter whether we use hot packs or infrared radiation just so long as we get the heat to the tissues we are trying to treat." Erdman and Stoner [19] stated that infrared, hotpacks, Hydrocollator packs, and Moistaire have the *same* local heating effects and *similar* peripheral reflex effects. Exactly how they relieved pain was not clear to these authors.

On the other hand, Wright [20] considers that with Moistaire temperature can be raised with more accurate control, greater comfort to the patient, and longer retention of deep tissue temperature after cessation of treatment. Elevations of body temperatures probably occur more rapidly in moist atmospheres because of the high humidity. Dry heat allows considerable heat loss due to sweating and radiation to the surrounding environment.

Summary

The exact mechanism responsible for the relief of pain by heat is not known. It has been suggested that: (1) heat is a counterirritant and thus has its effect through some neural mechanism; (2) it increases blood flow and thereby diminishes ischemic pain; (3) it acts by equalizing the thermal gradient between deep and superficial structures since a thermal gradient seems to cause pain; (4) it relaxes skeletal muscles, thereby mechanically relieving pain caused by muscle spasm; or (5) it may have some psychological effect on the pain reaction.

The heat prescription is, and probably will remain, empiric in nature until such time as the biophysicist, the physiologist, and the clinician can perform the research necessary to understanding heat energy and the various reactions of the living body to this energy.

Heating devices can be arbitrarily divided into those which produce superficial or deep heating; local or general heating; moist or dry heating; or any combination of these. Heating devices and

technics of application are many and varied, and the exact reasons for selecting one over another are not clear in many instances.

We in physical therapy might help to establish a scientific basis for the use of heat if we would begin to accumulate information about our patients so as to provide the gigantic amount of statistical material necessary for clinical research.

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Proprioceptive Neuromuscular Facilitation Film

A 35 minute color film with sound is available to chapters and schools of physical therapy at a rental fee of $10.00. One copy of the film has been given to the Association by the California Rehabilitation Center. Requests from states east of the Mississippi should be directed to the American Physical Therapy Association, 1790 Broadway, New York 19, New York; rental is payable to the American Physical Therapy Association. Those west of the Mississippi should write to California Rehabilitation Center, 2600 Alameda, Vallejo, California; rental is payable to the California Rehabilitation Center. All requests should be submitted two weeks in advance of date of showing. Alternate dates are desirable since both copies may have prior bookings.

The Physiological Effects of Cold Application*

Alma J. Murphy, Ph.D.

Introduction

Is cold an excitant or a depressant? This question was being asked about one hundred years ago. Spender,[37] in 1874, said that cold acts as a local tonic but, if continued too long or if too excessive, it will depress the part. Since that time additional studies of the degree and direction of the effect of the application of cold have been done and continued in greater detail as technological advances have been made in instrumentation and as more information is needed for space travel in the future.[1, 36]

Circulation—Blood Vessels

It is generally agreed that the application of cold to the body surface is followed by peripheral venous constriction, decreased peripheral blood flow, and increased venous pressure in the areas directly influenced by the cold.[6, 21, 34] While these peripheral changes are taking place, however, compensatory changes in the deeper vessels may be occurring.[34] For example, when cold is applied directly over the spine or abdomen, or is given in the form of a full cold water bath, dilation of the cerebral vessels will occur; but when cold is applied to the scalp, or directly to the brain, or nerve trunks, the vessels become constricted.[35] In a like manner, short, intense cold applications will cause dilation of blood vessels in the viscera.[34] Often peripheral vasoconstriction is followed later by an intermittent dilation in the superficial vessels. This was observed many years ago and was designated by Kellogg as the reactive effect.[34] This secondary dilative effect serves to preserve the viability of the tissues by preventing the skin temperature from dropping below a critical level. This reaction has led to many speculations that the short, intense, cold water douche has a tonic effect, stimulative effect, metabolic whip effect, effect of cleansing the skin, and elimination of poisonous wastes.[33, 34]

There are other effects of cold that are attributed to reflex relationships. When cold is applied to an area and vasoconstriction occurs, there is a concomitant vasoconstriction in other areas of a similar structure such as opposite arm or leg. Also, cold applied to an artery will cause constriction in its distal portions.[34] Cold applied to a nerve trunk sufficient to cause physiological failure of conduction will show evidence of causing vasoconstriction in adjacent areas outside the original nerve distribution.[34]

When hypothermy is prolonged and a low body temperature or low core temperature occurs, the blood pressure and peripheral pulse may disappear for hours and thereby slow the circulation.[25] This occurs in contrast to the effects of short, cold application over the heart, or of drinking cold water which will serve to raise the blood pressure.[34]

It has been found that the erect posture is tolerated more efficiently after a cold bath;[17] lymph flow was reduced and edema formation retarded when a part that had sustained a thermal burn was immersed in cold.[18] Cold has been used to retard swelling during the after care of patients who have undergone orthopedic surgery by applying ice bags to the area of surgery or over the newly applied cast.[24]

Heart

The effect of cold on the heart depends upon the duration and intensity of the cold stimulus. For example, short, and very cold applications over the heart have produced an increase in heart activity, force of contraction, and arterial pressure.[34] During prolonged application or during hypothermy when the body temperature is 75 degrees F., the heart rate diminishes, though rarely below 50 beats per minute, and the cardiac output per minute is decreased.[25] Cardiac arrhythmias and auricular fibrillations occur and the electrocardiographic tracings show significant changes from the normal.[28] Ergometric studies on hypothermic dogs showed that the contractile force of cardiac muscle increased with the decrease in rate of contraction.[16]

Metabolism

Cold has been used for many years to reduce elevated body temperature; however, in the course of the body's response to the application

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of cold a compensatory effect is sometimes observed. That is, a rise of the internal temperature occurs coincidently with the lowering of the external temperature.[34] This might be expected if considerable peripheral vasoconstriction occurred with dilation of deeper lying vessels. Moreover, shivering delays the decrease in rectal temperature and increases the heat production of the body.[3, 28] Almost all patients have been observed to shiver during hypothermy to 75 degrees F.[8] Body temperature and the total energy exchange may remain above basal levels throughout long periods of exposure to subnormal temperature.[8] It is usually necessary to assist hypothermic anesthesia with drugs to reduce this shivering response. However, when hypothermic anesthesia is accomplished, whether systemically or locally, the metabolic rate has been observed to be decreased from 20 to 50 per cent of normal.[25]

In order to reduce body temperature without recourse to hypothermia, it has been found that attention must be directed to both the skin and rectal temperatures. When there is a great difference between the two temperatures, indicating a diminished blood supply in the periphery, there will be less opportunity for heat loss from the core temperature with application of cold. But, if the peripheral circulation is observed to be adequate, the cold skin will then be perfused with heated blood from which heat can be extracted; or the circulation must be maintained or stimulated through vigorous massage or rubbing with ice in order to reduce body temperature.[19] Cold also causes sudden checking of perspiration, thereby lessening heat loss; but if a secondary reaction occurs, activity of the sweat glands may be resumed or even increased, consequently aiding heat loss.[34]

Respiration

We are all familiar with the gasping type of respiration that occurs when water of very cold temperature is applied abruptly and with strong pressure. Respiration becomes slower, and deeper;[34] that is, the tidal air is increased, but the minute volume may not be increased when the body is immersed for prolonged periods.

Cold immersion baths have been recommended for treatment of asthmatic attacks as a means of establishing a slower and deeper expiration and inspiration cycle.[34]

During hypothermic anesthesia, the respiratory problem takes on added significance with the changes in the oxygen and carbon dioxide content of the blood and resulting changes in the hydrogen ion concentration *p*H. It is the concensus that artificial hyperventilation is necessary to avoid the resulting complications and to maintain a normal *p*H.[8, 38] It is believed that spontaneous respirations cease due to the cooling effect on the medulla at temperatures varying from 28 degrees C. downward.[38] There is some evidence to suggest that diffusion of gases through the lung is poorer at these low body temperatures and that pulmonary edema and delayed deflation of the lung may occur in patients that have associated pulmonary dysfunction.[8]

Blood Chemistry

Because of the variation in conditions in which the studies on blood chemistry changes were made, it would be unwise to make a summary statement of the effects of cold applications. For example, if the fluid balance is not maintained during hypothermy, hemoconcentration follows with an increase in red cells to 25 per cent above normal.[28] The white cells and per cent of polymorphonuclears and reticulocytes increase as well as the sedimentation rate and platelet count. The blood sugar usually drops as a result of the effect of cold upon the vago-insulin and sympathetico-adrenal systems.[15, 25] But the problem of blood *p*H changes may be reflection of hyperventilation. Some observers[8] report acidosis as noted from a reduction in alkaline reserve while others[34] report alkalinity of the blood, with diminished acid phosphate perhaps as a reflection of an increase in muscle metabolism. It is generally agreed, though, that whole blood and plasma clotting time is increased during periods of hypothermia.[38]

Internal Organs

There have been a few observations of the effects of cold on the gastrointestinal system and other internal organs. As early as 1875, Fleury[34] showed that cold applied to the surface stimulated absorption by the gastrointestinal tract. This work was confirmed in 1940.[2]

Ice on the abdomen will increase gastric acidity as well as stimulate gastrointestinal motor activity. Drinking cold water causes the opposite effects.[34]

Most studies of the effects of cold on kidney function have revealed no changes, even when hypothermia was prolonged for days.[38] Moderately severe acute pancreatitis, however, has occurred in a number of hypothermic anesthesia cases.[25]

SKIN

The application of cold to the skin may reduce the circulation, but by reducing the metabolism a certain kind of tissue protection is offered. For example, it has been found that the colder the temperature of the tissue, the longer the period of pressure application must be before gangrene is produced.[3] Then too, cold may retard the development of infection and diminish damage due to impaired circulation. The successful use of cold following thermal burns may depend upon the severity of the burn.[18] Cold may reduce the severity of the burn, pain, and healing time in mild thermal burns;[10, 11] but in severe burns cold may prolong the healing time.[32] Penicillin has been used in conjunction with cold in the treatment of infected, superficial lesions. When applied to a cooled area, penicillin was retained at the infection site or was absorbed more slowly than when administered to an area kept at body temperature.[14]

Cold has also been used to preserve tissue for future use. Skin has been refrigerated for 60 days to 18 months before being used. Severed parts have been kept alive and resutured.[21] Intact local areas have been cooled to 40-50 degrees F. for several months without apparent damage or destruction of normal tissue. Generalized hypothermy has been maintained at 80-90 degrees F. for a week without obvious damage to tissues.[29] Generally speaking, there appear to be at least three independent factors that contribute to the production of injury of tissues through freezing: (1) length of time frozen, (2) temperature during frozen state, and (3) rate of thawing.[7] Thawing should proceed as rapidly as the capacity of the tissue or vascular system permits.[21]

Since cancerous tissues do not tolerate cold as well as normal tissues, this method has been used in controlling pain and, in some instances, the growth of tissue.[23, 28] Hypothermia, however, was more effective in relieving the pain of cancer than in stopping the growth or metastasis of cancerous cells.[23, 39] Patients did not need as much narcotics during the cold treatments and, in some instances, narcotic addiction was brought under control.[28]

MUSCLE

From the observations made on the effects of cold on nerve tissue, one would like to predict the effect on muscle tissue. This would be unwise, although studies made of manual dexterity, during exposure to cold, showed a lessening in dexterity when the skin temperature of the hand dropped to 50-55 degrees F. This did not occur if the hands were warmed but the body temperature cooled to 78 degrees F.[12, 13] Studies of the muscle twitch curve when the body temperature is reduced to 20 degrees C. reveals elongation of the latent time, contraction time, and relaxation time.[29] However, the peak twitch tension measured isometrically showed that an increase in tension developed.[30] Studies of work capacity fatigue curves, and gross body strength have indicated that short cold applications will increase the work output or contractile force, but prolonged application of extreme cold will diminish muscular work.[34] This may be a result of failing nerve conduction, for the muscle itself will still respond to direct stimulation even at extremely low temperatures.[4]

A recent study showed that in the human forearm the duration of a sustained contraction was longest in water of 18 degrees C. temperature; above or below this temperature of water, the duration was shorter. The maximum tension that could be exerted remained the same until the temperature of the muscle began to fall below a critical level of about 27 degrees C.[5]

NERVOUS SYSTEM

When cold is applied to nerve tissue we are more apt to observe the effects on the effectors rather than the receptors. It has been possible to apply cold directly to a mixed nerve bundle (carrying both motor and sympathetic nerves) so that the paralytic effects are noted separately in its motor nerve and autonomic nerve distributions. This produces the seemingly paradoxical situation of vasodilation within the directly involved autonomic nerve distribution and reflex vasoconstriction in adjacent areas.[34] Denervated or sympathectomized limbs, however, will show sudden vasoconstriction when critical temperatures are reached.[20] This is probably due to the increased cold sensitivity of the denervated vessels.

It has been observed that cold will first diminish the rate of transmission of impulses along a nerve and then, at about 27 degrees C. or lower, nerve conduction begins to fail.[21, 26, 34]

As the temperature falls, the potentials recorded from the midbrain show marked depression, especially from the reticular formation. Electrically induced seizure activity could not be elicited in cats with body temperatures of 26-28 degrees C. However, there appears to be a temperature range within which the activity of the dorsal column of the spinal cord is augmented. It is during this same range that the velocity of transmission across the synapse is

being diminished.[26] Also, when the muscle temperature is reduced toward 24 degrees C., the duration of the muscle action potential is prolonged and, with further decrease in temperature, the membrane potential at the end plate will begin to diminish.[4, 30]

As the warm blooded animal becomes progressively hypothermic initially, failure of coordinated movements takes place, followed by loss of consciousness and loss of pupillary or cranial reflexes, and then later, by loss of the spinal reflexes; while usually the respiratory reflexes from the medulla fail just before the cardiac rhythmaticity.[25, 28, 38]

Mental deterioration or nerve tissue damage that could have been attributed to the effects of cold *per se* have not been observed following recovery from hypothermia.[25]

SUMMARY

By way of a summary, the response of the body to the application of cold seems to serve to maintain the core temperature at the expense of the peripheral temperature. However, until a critical irreversible state is reached, the body makes certain adjustments to maintain viability of a part, even at the expense of the core temperature. Some of the observed phenomena of the direct effect of cold on specific tissues appear to be a result of a delayed biochemical process taking place under conditions of reduced temperatures.

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*Mechanisms of Pain Relief as a Result of Therapeutic Application of Ultrasound**

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Before discussing the clinical application of ultrasound and its effect on pain, it is well to keep in mind that first of all, in the suffering commonly associated with pain, we are not dealing with merely the effects of incoming afferent impulses, but we are confronted with an elaboration phenomenon extending throughout the central nervous system involving immediate pain eliciting impulses, in addition to many other complex personal experiences of the past and present. Second, the use of ultrasound as a clinical means to relieve suffering is a relatively new procedure—having been used rather extensively in the clinics of our country for approximately 10 years. Thus the task of attempting to present evidence for the relief of pain after treatment with ultrasound is an enormous and difficult one—presupposing knowledge and understanding in the fields of neurophysiology, psychology, biophysics and clinical ultrasonics—areas which even today are to a great extent inadequately developed.

In a review on the nature of pain,[26] Wolff and Hardy note the changing concepts relating to pain from the time of Aristotle when pain was considered a "passion of the soul"; through the early part of this century when pain was not considered a sensation such as touch or temperature, but a "feeling reaction" with no peripheral end-organs involved and no specific pain nerves or tracts; and on through the investigations of our time which lead one to conclude that pain is a specific sensation with its own structural and functional properties. However, evidence also supports the older "feeling-state-view," since it is known that pain is intimately linked with feelings and reactions, and can be modified by conditioning, strong beliefs, and attitudes. These latter factors may be, in many instances, the most significant aspects of pain for the patient.

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Technically, high frequency sound used therapeutically is produced by causing a quartz crystal located in the ultrasound treatment head to oscillate in an electric field at a frequency of approximately one million cycles per second. The ultrasonic vibrations of this crystal are transmitted to the head of the transducer and introduced into the tissues by means of a coupling medium. In addition to frequency, other important factors involved in therapeutic application of ultrasound are: time; energy emitted, usually stated as watts per centimeter square of the surface of the emitter (w/cm^2); technic, movable or stationary head; use of pulsed or constant ultrasonic emission;[6] and the type and temperature of the coupling medium.[16]

A common concern of persons interested in the literature reporting on the medical application of ultrasound is the tremendous number of papers which contain exaggerated and scientifically uncritical results and conclusions. One possible reason may be that the physical, biological, and medical sciences are involved, and research groups have not always included investigators familiar with all of these sciences. A number of investigators, however, have seriously studied the action of ultrasound on tissues and much of our knowledge of the mechanisms and the effects of ultrasound on tissues stems from their studies.

Throughout the literature, many authors note the "analgesic effect" of ultrasound in a great variety of conditions treated in the clinic: It seems the problem to be solved is whether the apparent pain relieving effect is a specific effect of ultrasonic energy on a tissue, or whether it is due to some secondary effect.

In 1957, Schwartz[21] presented an impressive list of neuromuscular and skeletal muscular diseases which he treated with low intensities of ultrasound (1.5 w/cm^2), and claimed great improvement in pain and spasm in 80 per cent of the cases. Morris and Clemmons[19] were able to relieve severe angina pain with ultrasound. Other authors [4, 5, 7, 12, 22, 28] saw satisfactory results in a high percentage of patients with con-

ditions such as: bursitis, tendonitis, tenosynovitis, epicondylitis, cervical radiculitis, hypertrophic arthritis, rheumatoid arthritis, acute gout, rheumatoid arthritis of the spine, osteitis deformans, back pain, muscle pains, myositis, neuritis, neuromas, sinusitis, scleroderma, and numerous other conditions. In one placebo study on the effect of ultrasound on periarthritis of the shoulder, some patients were treated with the ultrasound power on, whereas control patients received the identical treatment but with the ultrasound power off. No statistically significant improvement was noted in either group; the greatest gain having been noted in the placebo group.[20]

In the search for a possible mechanism to explain the pain-relieving effect of ultrasonic energy, investigations have shown that peripheral nerve function can be damaged or altered by the application of ultrasound. Peripheral nerves have a high absorption capacity for ultrasound;[6] even in situ a nerve exposed to high intensity sound is damaged while surrounding muscle fibers remain intact.[18]

Effects of very high intensity ultrasound (35 w/cm^2 and higher dosage) on animal nervous tissue have been carefully investigated by Fry and co-workers,[8, 9] and they have shown that frog sciatic nerve can be damaged when temperature elevation and tendency for cavitation due to sonation are essentially prevented. They conclude that some other factor is the primary physical factor involved in the mechanism producing permanent changes in nervous tissue under these conditions.

On the other hand, Fry notes that ultrasound effects at therapeutic intensities (.5 - 4 w/cm^2) seem to be related to a thermal effect; cavitation is not seen at therapeutic intensities, and effects on tissue at these levels appear to be reversible.

In an early paper, Lehmann[16] using a therapeutic dose of ultrasound showed that selective heating of tissues lengthens chronaxie, causes hyperemia and increases metabolism. He explained this selective heating as a result of temperature increases at tissue interfaces between tissues of different acoustic impedance. He also notes a possible mechanical effect which seems to augment the exchange of metabolites. In a later paper,[17] Lehmann notes that Alyea and co-workers[1] found that ultrasound applied to the ulnar nerve in humans produced an increase of threshold of vibration perception. From Lehmann's own investigation on the effect of therapeutic intensities of ultrasound, infrared, and microwave on the ulnar nerve, he has shown that elevation of the pain threshold does occur with ultrasound and infrared, and that no essential difference in the analgesic effect was noted between the two energies. This is in agreement with other similar investigations.[11, 2] Results with microwave radiation were variable due to the marked tendency for energy reflection at tissue interfaces.

In review of the effects of ultrasound on nervous tissue, it can be said that ultrasound applied at therapeutic intensities can—

1. selectively heat peripheral nerves,
2. alter or block impulse conduction (action potential),
3. alter the permeability of certain biologic membranes,[6]
4. increase tissue metabolism.

It is evident that any of the above alterations to the integrity of the nerve fiber can produce an effect which can result in the relief of pain.

It is also evident from the studies reviewed, that the above effects on the peripheral nerve can be obtained by direct heating of the tissue, and that as yet no good experimental evidence for a specific mechanical or chemical effect of ultrasonic energy is available. Most careful investigators conclude that in the light of present evidence, the thermal effect of ultrasonic energy is probably the major factor producing effects on the peripheral nerve, which in turn may be the factor responsible for the analgesic response.

As mentioned previously, in the perception of the sensation of pain we are not only dealing with the effects of incoming afferent impulses, but in the patient, the total experience is complex and can involve the entire central nervous system.[3, 10, 13, 26] It can be readily determined that pain experiences can be of a personal nature, and that pain sensations can evoke responses beyond those appropriate, and out of all proportion to the danger of the situation. Instances of this are seen in the indifference to injury sustained during the excitement of games or combat; the apathy that accompanies tissue damage during certain religious and mystical practices; the indifference to pain often witnessed during parturition in women who are confident in their physician and desirous of bearing a child.[26]

The problem of pain experience and its relationship to personality structure, personal past history, habits and attitudes has been studied by investigators interested in the pharmacological action of certain drugs including those for the relief of pain.[14, 15, 23, 24] They note that many favorable reports on the effectiveness of a drug are published without taking into account extensive physiological changes that may follow the

administration of placebos. They find that inert substances such as lactose and saline can provide striking relief for a wide variety of symptoms and can frequently produce "side reactions" of various sorts.

Wolf and co-workers[24] found that the effects of Tolserol on the manifestations of anxiety were almost identical whether the patient was taking the drug or a placebo.

Lasagna and co-workers[15] describe lesser known aspects of the action of placebo which mimic characteristics of active drugs. These are:

(1) a time effect curve seen with the placebo (a maximum effect of drug action is typically achieved at a certain point in time), (2) cumulative effects (effects of repeated doses), and (3) carry-over effects (persistent benefit after cessation of treatment).

They found an amazing parallelism between the performance of the drug and the performance of the placebo. However, they note that the percentage of pain relief is higher (57 per cent) in patients whose pain was evaluated as slight-to-moderate, as compared to the patients in the severe-to-very-severe pain group (21 per cent). In an earlier study of the placebo responses,[14] Lasagna and co-workers using personal interviews and Rorschach test results investigated personality differences in patients who showed a high percentage of placebo response ("placebo reactors"), and patients who showed little or no response to placebos ("placebo nonreactors"). They found that "placebo reactors" had more somatic pains; used more drugs, cathartics and aspirin; were more emotionally expressive especially about themselves, their problems and bodily processes; and were generally less mature. In contrast, the "placebo nonreactors" showed these traits to a lesser degree and were generally more rigid and emotionally controlled. They also report that "in stressful postoperative situations, 'placebo reactors' behave in immature, dependent, and yet more outwardly responsive fashions, and thus receive considerable relief of pain through comfort received from attentive nursing care and from their confidence in the effectiveness of drugs. On the other hand, the 'nonreactors,' who are withdrawn, and who rigidly cling to critical intellectual processes, are less comforted by the care received and evidently are more critical of drug effects." It is of interest that the investigators were not intially able to identify patients later designated as "placebo reactors" and "nonreactors," and stress that "reactors" were not "whiners" or "nuisances," not typically male or female, young or old, and had the same average intelligence as the "nonreactors."

It is evident from these studies that there is a certain segment of our patient population which predisposes to anticipation of pain relief after treatment with active agents or placebos. This situation is acknowledged by investigators of pharmacological agents and can conceivably be paralleled with the investigation of physical treatment methods.

From the investigations on the pain-relieving effect of ultrasonic energy, it seems many of the effects seen at therapeutic levels can be ascribed to the secondary effect of tissue heating which accompanies the propagation of sound through the tissues. However, evidence exists which appears to indicate that some tissue effects are of a nonthermal nature—especially at high acoustic intensity levels.

The investigations of the power of a placebo to influence pain, anxiety or other "subjective" states in certain persons is of extreme importance when a new drug or treatment procedure is evaluated. The data on severity of complaint of pain and placebo effectiveness are of interest, since many of the conditions treated with ultrasound can be classified in the slight-to-moderate pain group, the group reporting a high percentage of pain relief from placebo.

In conclusion, the use of ultrasound in medicine is in a period that calls for more carefully controlled, scientific investigations which can produce objective results for the evaluation of mechanisms of ultrasonic effects on biological structures.

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Case Reports

*Facilitation Technics in the Treatment of Early Rheumatoid Arthritis**

Marjorie K. Ionta

A 40 year old secretary, the divorced mother of one child, entered this hospital on March 24, 1959, with the chief complaint of swollen, painful joints of six weeks' duration.

According to the patient's history she had enjoyed good health until after her father's death from cancer six months previously. She had cared for her father in his serious illness; during this period and following his death, she noticed that she was chronically fatigued.

Five months before admission she had undergone a total hysterectomy because of a fibroid tumor of the uterus which had been discovered during a routine physical examination. The patient's postoperative course was uneventful.

Shortly after leaving the hospital the patient began working in her stepmother's restaurant and found that the work required a great deal of physical effort. Again she was bothered by extensive fatigue.

Six weeks prior to admission the patient awakened one morning to find that she could not extend the fingers of her right hand and that her right wrist was extremely painful. On the following day her left shoulder became painful and she suffered generalized aching of all joints. A few days later, the right knee became very "stiff," swollen and painful. These symptoms were worse in the morning and all motions were difficult to perform on the first attempt.

Physical examination and evaluation on admission revealed a tense apprehensive patient with weakness and limited range of motion in the right knee, right wrist and fingers, and both shoulders. The patient could not use her right hand for activities of daily living such as holding a cup or glass, cutting meat, or combing her hair. Walking was limited to "hobbling around" on her left leg.

Laboratory findings revealed an increased sedimentation rate and the radiological findings were consistent with the diagnosis of early rheumatoid arthritis.

The patient was put on a regimen of bed rest, a daily hot bath, Hydrocollator packs twice daily to both shoulders, knees, right hand and wrist. The medications prescribed for the patient were 3 Bufferin tablets 4 times daily, 30 milligrams phenobarbital by mouth 3 times daily, and 0.1 gram of Seconal at bedtime as needed. As the patient became less apprehensive and tense, the dosage of phenobarbital and Seconal was decreased accordingly.

On March 26, two days after admission, the patient was referred to the physical therapy department. A program of exercises was established for strengthening all muscle groups related to the involved joints and for maintaining and increasing the range of motion of these joints, as well as maintenance of strength and range of motion in all uninvolved body segments.

At the first visit, joint range measurements revealed that the patient could actively extend her right knee to within 15 degrees of complete extension and could flex it to 90 degrees, the range being 75 degrees. She could extend her right wrist 30 degrees and could flex it to 55 degrees, the range being 85 degrees. Range of flexion of the right index

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finger was 50 degrees at the metacarpophalangeal joint, 55 degrees at the proximal interphalangeal joint, and 45 degrees at the distal interphalangeal joint. The patient could flex her right shoulder 160 degrees, internally rotate 45 degrees, and externally rotate 70 degrees. Limitation of the left shoulder was minimum, lacking 10 degrees of complete flexion, internal rotation, and external rotation.

Before each exercise period, Hydrocollator packs were applied to the involved areas by the nursing staff. The patient felt that the heat helped to relieve the stiffness and the pain in the involved joints.

Technics of proprioceptive neuromuscular facilitation as described by Knott and Voss have been used in this hospital in the treatment of patients having rheumatoid arthritis. For this particular patient the technic of rhythmic stabilization was indicated because in rhythmic stabilization resistance can be applied gradually and gently to isometric contractions without producing pain. Following rhythmic stabilization of the involved joints with resultant relaxation, the patient was instructed and performed actively all patterns of motion through the pain free range of flexion and extension of the right knee; all motions of both shoulders; flexion and extension patterns of the right wrist with closing and opening of the hand. For the maintenance of strength and range of motion of the uninvolved body segments, the patient was instructed in active patterns of motion for the neck, trunk, and left leg. Breathing exercises were also done.

The patient was treated daily and was urged to perform the patterns of motion during two additional periods. She was cautioned to work only through the pain free range, but to put as much effort into the movements as she possibly could. Emphasis was on improvement of upper extremity function so as to achieve self care and ambulation as rapidly as possible. By the fourth day minimal but definite improvement of ranges of motion was noted; the right wrist had gained 20 degrees (45 degrees of extension, 60 degrees of flexion); the metacarpophalangeal joint of the right index finger had gained 18 degrees of flexion (68 degrees of flexion), the proximal interphalangeal joint had gained 10 degrees (65 degrees of flexion), and the distal interphalangeal joint had gained only 5 degrees (50 degrees of flexion). The patient could now hold a cup or glass in her right hand without pain and without dropping it.

Eight days after treatment was started, on April 2, the patient had achieved full range of active motion of her left shoulder; she had gained 10 degrees of motion in flexion and internal rotation of the right shoulder and 5 degrees of external rotation. She also was able to extend her right knee to within 10 degrees of complete extension, and flex to 105 degrees.

On April 4, after 10 days of treatment, the patient used her right hand to cut meat while feeding herself, and could put her hair up in pin curls. At this time she was given axillary crutches and instructed in the use of a four point gait. She was permitted to use the crutches for bathroom privileges only.

At the time of discharge on April 6, the patient had been hospitalized for 14 days and had been on a regimen of bed rest and exercises. The following ranges of motion were recorded: right knee extension to within 5 degrees of complete extension, flexion 115 degrees; right wrist extension 60 degrees, flexion 65 degrees; flexion of the right index finger metacarpophalangeal joint 80 degrees, 75 degrees of the proximal interphalangeal joint, and 60 degrees of the distal interphalangeal joint; right shoulder flexion 175 degrees, internal rotation 65 degrees, and external rotation 80 degrees.

The patient was discharged to her home to continue a regimen of bed rest, a daily hot bath, 3 Bufferin tablets 4 times a day, and the exercise program that she was instructed in during her hospital stay.

Arrangements were made for follow-up treatments every two weeks, for reevaluation of range of motion, strength, and review of the exercise program.

On April 21, two weeks after discharge, the patient returned to the clinic for her first visit. Joint measurements, compared with the discharge recordings, revealed a loss of 5 degrees of extension of the right wrist; 10 degrees in the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints of the right index finger. Right wrist flexion had increased 5 degrees, and the range of motion of all other joints had been maintained.

How to Arrange to Borrow a Print of *The Return*

A complete listing of the film libraries where the Association's latest film is on deposit may be found on page 99 ff. of the February, 1959, issue of the *Physical Therapy Review*. If the film library nearest you cannot supply you on the date you need *The Return*, look through the list to see if another library will service your state. National Office will send you a print if it is unavailable locally. In addition to the 38-minute version, there is a TV version running 28 minutes. There is also a 58-second TV spot with sound track, excerpted from *The Return*. Both of these are available for borrowing from the National Office. *The Return* was chosen by Howard Thompson of *The New York Times* as one of the 10 best nontheatrical films of 1958.

Suggestions from the Field

Hip Flexor Aid

James K. Simon, B.S.

The hip flexor aid has been designed to assist weakened muscles or to substitute for loss of power when flaccid paralysis is present. It is known that the ability to do the swing-through gait requires strong extensors of the forearm and shoulder depressors. In the young child with flaccid paralysis of the lower extremities from trauma, poliomyelitis, or spina bifida, this is usually impossible until the child reaches the age of 5 or 6 years. Most young children can, however, learn the four-point crutch gait at 2 years of age. It is with these children that the hip flexor device demonstrates its usefulness for, to accomplish this gait, it is necessary that some power in hip flexors or muscles which elevate the pelvis be present.

The device itself consists of a hip lever arm attached to the lateral bar of a Knight spinal brace or to the outer aspect of the pelvic band (Fig. 1). The spring originates at the distal end of the hip lever arm and is secured 3 to 4 inches above the knee lock on the lateral aspect of the long leg braces. The selected spring may be of varying length and tension as required by the patient and may be purchased in any hardware store. When exploring the needs of a particular patient, a wide choice of springs should be available. Clothing needs no extra protection since the angle of the hip lever eliminates the problem of clothing being caught in the spring (Fig. 2).

The training period is similar to normal pro-

Physical Therapist, Children's Division, New York University—Bellevue Medical Center, Institute of Physical Medicine and Rehabilitation, New York.

Figure 1. Hip lever arm with spring attachment.

Figure 2. Modification in lever arm providing improved angle of pull and aid in clothing problem

cedure for independent ambulation; however, the patient must learn to shift the body weight away from the spring. The leg is then brought forward mechanically 6 to 12 inches depending upon the patient's need. To complete the gait cycle, the opposite side is pulled or dragged to. The gait pattern may be modified by using spring assists bilaterally; by having limited motion in the brace joint itself; or the assist may be used on one side, with the opposite side locked.

This assist can be used to advantage for children and adults. Only minor modifications in the spring and lever bar such as angle of pull, or tension of spring, are necessary.

Mobile Insulated Hot Pack Cart

Donald Dykinga, B.A., B.S.

This is a specially designed cart to carry several Hydrocollator packs to various parts of a hospital.

The insulated cart serves to keep the packs hot for as long as six hours, provides a safe and easy way to transport the packs, and conserves the therapist's time since the packs may be conveniently located.

Basically the cart consists of two parts—an insulated cabinet made of stainless steel and a stand (Fig. 1.) The cabinet is 24 inches long, 17 inches wide, and 9⅛ inches deep, insulated with a 2 inch layer of fiber glass on the sides and bottom. The top has ½ inch of insulation. A spigot in the bottom of the cabinet permits drainage of excess water. Attached to opposite ends of the cabinet are two handles. The cabinet is supported by four legs of 1 inch tubular steel and a shelf with 2 inch siding that is welded to the cabinet. Nonconductive 4 inch rubber wheels are fastened to the bottom of each leg.

The technic for using the cart is:

1. Preheat the cabinet with two hot Hydrocollator packs for 10 minutes.
2. Remove the two packs and fill the cabinet with 12 large or 14 small heated packs. The cart is then ready to be taken to the wards.
3. Take out one pack at a time and hang on handle for cooling, if necessary. This procedure permits the top to be closed so as to retain heat in the unused packs.
4. The top serves as a convenient working area when preparing packs for application.
5. Used packs may be placed on the shelf along with used towels; a clean towel folded around the packs and towels prevents dampening or contamination of the remaining clean towel supply.

Director, Physical Therapy Department, Illinois Masonic Hospital, Chicago.

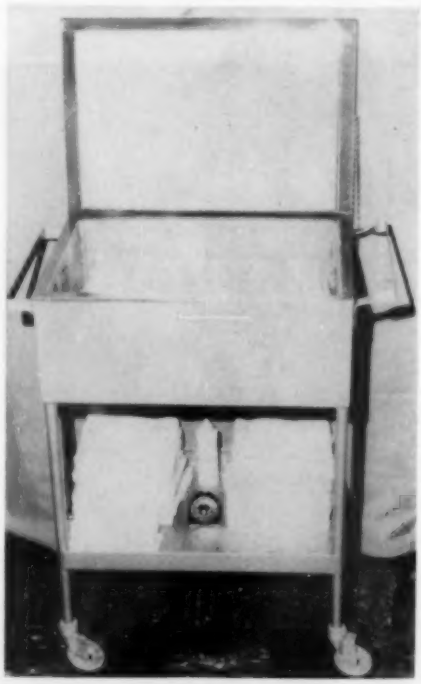

Figure 1. Insulated cart with top open.

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Editorial

This issue of the *Review* comes to you as a memorial and tribute to Mary McMillan. We propose herewith a greater honor, a more sincere tribute. Let every physical therapist re-dedicate himself to full and active support of the ideals and standards which Mary McMillan and the other charter members of the American Physical Therapy Association envisioned at its founding. The things of which she wrote and spoke during the infancy of our profession are still the goals we seek today. Standards were a solemn and vital thing to our founders who recognized this keystone to a profession. Standards of education, standards of service are set, maintained, and laboriously raised by the work we do as individuals and by our collective endeavors.

There is need for research today as in 1921 when Mary McMillan wrote in the preface to *Massage and Therapeutic Exercise* of "the large field for future study"; "the linking of the various branches"; and "the testing—in order to obtain the most beneficial results." There is need for textbooks by members of the profession to emulate and honor the first in our Association to provide a textbook for professional use by students and graduates. There is need today to seek and achieve uniformity in such areas as functional evaluation and muscle testing just as Mary McMillan cried the need in 1932 for standardization of the nomenclature of arthritis.

These things and many, many more are waiting to be done. They will be done if we take the route marked by Miss McMillan in her first presidential address; "The easy path in the lowland has nothing of grand or new; but a toilsome ascent leads on to a glorious view." We need that view—the vision to keep up with new developments and the latest advances. Mary McMillan spoke words in 1922 which apply in 1960: "We have so much valuable material for further study why not decide to make ourselves more efficient in our own special line of work and so not only raise our own standard but increase our possibilities of forging ahead in our profession." Why not indeed fulfill this obligation to the survival of the profession? Why rebel against emphasis on service rather than security when security and satisfaction are the direct products of service? Miss McMillan spoke facts not platitudes in her 1949 aside to younger members: "— go into it. It is not a static thing—there is not one that has put hard work into it that does not feel tremendous reward. It is not because you give; it is simply the law that if you give and give of yourself, you get a great deal out of it."

Mary McMillan believed in our profession from the beginning of her career to her death. She not only devoted her life to supporting the profession, she bequeathed a large part of her estate to its future for scholarships. Let each of us lend our share of support to her continuing benevolence by enlisting students worthy of her trust. Let us here promise to reach our goals that new ones may be set. Let us achieve a rate of ascent to the "glorious view" of Mollie's that she may be perpetually honored.

Mary McMillan
1880-1959

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MARY McMILLAN

As we gather here in the House of God for these last offices of faith and of love, our sorrow is intermingled and transformed by our thanksgiving. We give thanks to Almighty God that the one whom we remember in our hearts and in our prayers was, and ever will be, part of us, because she lived among us.

So rarely is our checkered human existence blessed by one of whom it can be truly said, in the deepest meaning of the words, that "she went about doing good." What our friend and loved one did was the natural, inevitable expression and overflow of her Christian faith, and of her concern for people and their well-being. By what she did and by what she was in herself, the Master and Lord in Whom she believed, and with Whom she walked so closely, touched our lives, and touched the lives of a whole multitude of people in many parts of the world. Her days and her deeds had a quality of selflessness that freed her from the bondage of self concern that thwarts and confines the lives of so many of the rest of us.

Her achievements in medical circles made her known internationally, and true to character, she was quite unimpressed by this fact; she wanted only to serve. Her friends, and the people who are indebted to her for a better life, make up a worldwide company. A multitude of nameless and to her unremembered acts of kindness and of love, live on in many hearts.

Her courage and fortitude in the days of the adversity both of war and of peace are a precious legacy of encouragement; her affection and her concern are our abiding treasure; and her devoted life of Christian faith and service is for us all both example and guidance.

We Congregationalists do not canonize the outstandingly faithful for their deeds, but if we did Mary—Mollie—McMillan would be a likely candidate because of what she did, but most of all, because of what she was in herself.

THE REVEREND FREDERICK M. MEEK, D.D.,
Minister, Old South Church in Boston, Congregational

The eulogy by Dr. Meek was read during services for Miss McMillan on Oct. 27, 1959, at Harvard Church, Brookline.

We are grateful to the family, friends, charter members, and all others who contributed to the development of this Mary McMillan issue of the *Review*. Appreciation is extended to Robert L. McMillan and Edward N. McMillan, nephews; and to Mrs. Elizabeth M. Buckley, the sister who lived with Miss McMillan, for photographs and records from Mollie's personal files. Col. Emma E. Vogel and Lt. Col. Harriet S. Lee have been most helpful in the validation of information and in securing photographs. To Mary E. Haskell, Executive Director of the Association from 1956-1958, who prepared the editorial, the biography entitled, "Mary McMillan 1880-1959," and the compilation of excerpts from letters received in tribute to Mollie McMillan—our especial thanks are due.

DOROTHY E. VOSS
Editor in Chief

MARY McMILLAN

1880 — 1959

The life and living of Mary McMillan tower as her own monument—an eternal beacon to all in the physical therapy profession. It was she who set the continuing keynote for the development of purpose of the American Physical Therapy Association. As its first president welcoming members to its first national meeting, she said: "Many of us have met in various places —. It makes no difference where. We are now invited to be of service in establishing our profession, to be instrumental in formulating a standard and then to assist in maintaining such a standard."

Born in Hyde Park, Massachusetts, on Nov. 28, 1880, Miss McMillan grew up in England where she decided upon a career in physical therapy in 1900. In the intervening years to 1959, when during her final illness, she sent greetings to the Third Congress of the World Confederation for Physical Therapy, she never faltered in her belief and dreams for the role the profession should play in "enabling [them] to resume the activities of life." And beyond 1959 the generous bequest of Mary McMillan whereby scholarships for students in physical therapy are to be established endows her inspiration and example to future generations of physical therapists leading lives of service to meet the needs of the people.

Miss McMillan's interest in corrective work was confirmed when she had completed a two year course at the Liverpool, England, College for Physical Culture. This only served as the takeoff point in a life of constant pursuit of professional knowledge and insight. Witness her immediate enrollment for postgraduate courses in medical sciences and later extensive pioneer experiments to obtain just the right flesh color to dye bandages for a sensitive patient to wear.

Until 1915 Mollie studied and worked in England during which time she was associated with Sir Robert Jones. She worked at the Southern Hospital and later was in charge of physical therapy at the Greenbank Home for Crippled Children, both in Liverpool.

It was Sir Robert Jones who advised the United States Army of her training and skills. Thus she left the position of Director of Massage at the Children's Hospital in Portland, Maine, and was appointed on Feb. 23, 1918, as Reconstruction Aide in the Medical Department of the United States Army. Assigned to Walter Reed General Hospital she was promoted to the position of Head Reconstruction Aide on March 3, 1918.

Later in 1918 she was given an extended leave of absence from the Medical Department and with great eagerness went to Reed College in

Anatomy class at Reed College—1918

Portland, Oregon, to conduct a special emergency course to prepare women for service with the Army. The Reed College Newsletter of Apr. 2, 1919, reports: "Reed College has furnished the U. S. Army with 179 trained women—assigned as Reconstruction Aides in Physiotherapy to 40 military hospitals in all parts of the United States —now treating more than 2,000 wounded soldiers chiefly by means of massage, remedial exercises, and hydrotherapy." These Aides were all civilian employees who were "With but not of the Army" enjoying none of the benefits and privileges of military status. It is from many of the Reed graduates that come such warm words of love and respect for Mollie McMillan—the teacher, leader, and person.

After training a second class at Reed College, Miss McMillan returned to the Surgeon General's Office in Washington on Jan. 30, 1919, to help with plans for closing various emergency hospitals where Reconstruction Units had been at work. On March 15, 1919, Mollie received orders to serve as Chief Head Aide in the Department of Physiotherapy, Walter Reed General Hospital. Then on Oct. 16, 1919, she became Supervisor of Reconstruction Aides in Physiotherapy, Medical Department at Large, Office of the Surgeon General.

Miss McMillan resigned from the Army in June, 1920, and returned to Boston where she worked for the next 13 years as physiotherapist with the eminent orthopedic surgeon, E. G. Brackett. During this time with Dr. Frank B. Granger she was also co-director of physiotherapy postgraduate courses Nos. 441 and 442 of the Harvard Medical School. It was Dr. Granger who had helped initiate and served as first Chief of the Reconstruction Service in the Surgeon General's Office during World War I.

In the early part of 1920 a committee at Walter Reed Hospital started the American Women's Physical Therapeutic Association. At first, invitations were sent only to those who had left the service; consequently, the Association did not gain ground very fast. In December, 1920, approximately 800 circular letters were sent to those both in and out of the service who might wish to join a national organization. The enthusiastic response must certainly be considered the conception of the American Physical Therapy Association. These letters called for nominations to office in the organization. One hundred twenty forms were returned from which a nominating committee compiled a ballot sent to the 200 paid up members.

On Jan. 15, 1921, a meeting of 30 Aides and 5 physicians was held at Keen's Chop House, New York City, to discuss the question of forming a national P.T. association with all the branches under one constitution and with national officers. On March 24, the election results revealed that Miss Mary McMillan had been elected for one year as the first president of the American Women's Physical Therapeutic Association—which was even then considering omitting the word "Women's" so that men equally qualified might be admitted.

At the Re-Aides Club in Washington, Mary McMillan uses her leisure time to write *Massage and Therapeutic Exercise*.

Miss McMillan's first message to the members of the Association was published in the second (June, 1921) issue of the *P. T. Review*. In this message she said that there was no cause dearer to her heart than the Association. The message went on to outline functions for such an association and again reveal the insight of this founding president: use of the *P. T. Review* as a means of keeping together; listing of educational courses to encourage further study; and the setting of standards for professional practice. "Now that we are truly a national association it is up to you and to me to see to it that our foundation is laid on sound principles that will endure."

In 1922 by a mail ballot the name of the Association was changed to the American Physiotherapy Association and Mary McMillan was reelected president for a term of one year.

The year 1921 also dates the publication by W. B. Saunders Company of *Massage and Therapeutic Exercise* by Mary McMillan. This was the first textbook on physical therapy by an American physical therapist and to this date no other American physical therapist has written one as comprehensive. The third and last edition of the book was published in 1932. Dr. Brackett wrote the foreword in which he acknowledged

With her sister, Kay, Mollie McMillan shares the quiet of her Chinese garden.

Miss McMillan's qualifications as an authority. He further commented: "It has been the desire of all of us who were occupied with the physical reconstruction of the injured during the war to so preserve the resources developed during this period that they may be turned to the relief of the industrial reconstruction, which problem we shall always have with us."

In her preface Miss McMillan quoted Dr. Harvey Cushing's address to the 1919 meeting of the Congress of American Physicians and Surgeons. "This has come to the minds of all, and mayhaps a new profession for women as important as the nursing profession may arise through their invaluable services as Reconstruction Aides." Miss McMillan then went on to list four distinct branches in physical therapeutics, (massage, therapeutic exercises, electrotherapy, and hydrotherapy) and to challenge: "the linking of the various branches that comprise the subject as a whole and the testing of the combination of one branch with another in order to obtain the most beneficial results are still matters for serious consideration."

Mollie's sense of humor was one of her most frequently mentioned endearing traits. Entertainment at the annual dinner of the American Physiotherapy Association held in Philadelphia in 1931 was a skit in one act entitled, "Major Bonesache" by Mary McMillan. Characters: Major Bonesache, Medical Corps U.S.A., Helen E. Bolton; Corporal Laidlow, a Cockney soldier in U.S.A., Mary McMillan; Miss Ophelia Strength, Reconstruction Aide, Constance Shields. Place, Doctor's office, Any Army Hospital. Time, 1918.

In 1932 came the new and exciting assignment, which Mary McMillan referred to as "one of the most interesting phases of my work," selection by the China Medical Board of the Rockefeller Foundation to work in the Peking Union Medical College. Mollie effectively summarized her experience there in "Physical Therapy on Three Continents" which is reprinted in this issue of the *Review*. In a recent personal communication her reminiscence seemed to contain an essence of why she was beloved and why she was happy. "I loved my flower courtyard in China and took much pride in the planning. One summer I had only gold flowers; nasturtiums, calendulas, African marigolds, large yellow daisies, and yellow and orange tall lilies. The courtyard was a breath taking blaze of color when the sun was upon it. Just glorious!!!"

After a short furlough at home in 1941 Miss McMillan returned to China 10 months before Pearl Harbor to release a Chinese physician to come to this country for further training in physical therapy and to release one of the physical therapists for war work. Then, at the age of 61, Mary McMillan was forced by approaching war to leave China. By way of Shanghai she arrived in Manila on Dec. 2, 1941, and went beyond to

Mary McMillan with students at Peiping Medical College.

Our Founding President greets Mildred Elson, first President of the World Confederation for Physical Therapy, during Second Congress in New York, 1956.

the mountain resort of Baguio. It was while there dining at a table next to Quezon cabinet members that the disaster at Pearl Harbor was announced. She returned to Manila as soon as possible after December 7 and immediately volunteered her services to the Army Hospital. Then followed three weeks of constant bombardment. While the Japanese were preparing to enter Manila, Mollie and three other women loaded and "rescued" a truck of medical supplies and instruments which were subsequently used by the Red Cross to keep the Santo Tomas internment camp hospital going for many months.

Here in internment camp Miss McMillan embarked on her last clinical work in physical therapy—"the one outstanding joy of that existence—the real joy experienced of service without money and without price, without any equipment, without trained workers, without adequate food to keep the body fires burning —." Without equipment? No, a dishpan and a couple of buckets which must be slept with to retain title. Without food? No, tea and rice, rice and tea. Without comfort? No, one outfit of clothes with a raincoat to serve as cover, mattress, and pillow; a filing cabinet for a bed; a butter firkin for a seat; one bathroom equipped with three showers, four toilets, and two wash bowls to share with 469 other women. Without trained workers and equipment? No, two skilled hands, a fertile brain and a noble, gentle compassionate heart. A fellow physical therapist and internee, Brunetta Kuelthau Gillet, has written "She was so wonderful when she came to Sternberg Hospital at the start of the war and again in Santo Tomas. She did so much for everyone and was such an inspiration to all of us all her life."

From her experience in treating another internee Miss McMillan has pointed up for us the opportunities and satisfaction for physical therapists who bring these resources to their work: sympathetic understanding, judgment, health of mind and body, good cheer, awareness, faith in oneself and holding out *true* hope for one's patients.

After eight and one-half months in Santo Tomas, Miss McMillan was transferred with other internees and a ship load of horses to the Chapei internment camp near Shanghai. There she was kept for several more months suffering from beri-beri, herpes zoster, and multiple neuritis. She was returned to the United States late in 1943 aboard the Gripsholm with the first group of repatriates.

Mary McMillan referred to her work in the Japanese internment camp as her "swan song." For clinical work that is true. There was no "swan song" of her contributions to the profession. Whenever she could, she attended the Association's national conferences. In 1944 in New York City, Mollie was awarded Honorary membership in the Association, the first such honor to a physical therapist.

Reception at Sargent College following Pinning Ceremony in February, 1959, where Mary McMillan spoke to physical therapy students—the last of many such inspirational occasions.

Young physical therapists who listened at the 1946 Conference to her story of physical therapy on three continents said, "This is the inspiration we've been seeking." She invariably welcomed and accepted invitations to speak to students of physical therapy. Undergraduates from Boston to Los Angeles would say, "Now we understand the profession."

During the 1949 Conference in Boston, in response to a tribute by the Association, Mollie in her characteristically modest way said, "No, friends, it is not to me that credit or honor is due for the growth and development of the Association. It is to the chapter presidents, past and present, the national officers, past and present, who meet at convention and other times from early morning until late in the evening to help iron out our problems. It is to your directors, standing committees, advisory committees, it is to the years of devoted service of the executive secretary, (Executive Director) and staff, to those in the Army who throughout the years have fought and won military status for Army physical therapists, it is to those who for years gave of their time and talents to make the *Physical Therapy Review* a success. It is to all these that *I would like to do honor*. The national Association has given to me so much, you have enriched my life exceedingly and made me very happy."

She was an important and popular program participant at the Second Congress of the World Confederation in New York in 1956. She was enthusiastically interested in all chapter activities and attended the 1958 Conference in Seattle as a delegate from Massachusetts, her last official service to the Association. There former Reed College students and the newest members alike said, "We must live up to her expectations."

Mary McMillan died in Boston, Massachusetts, on Oct. 24, 1959. Her funeral was held in Harvard Church, Brookline, on October 27. This was Mary McMillan, the physical therapist, because she was Mary McMillan the woman, eulogized as saintly not only because of what she did but because of what she was.

About Mollie McMillan

> "Whatever is, is right. Though purblind man
> See but part o' the chain, the nearest link:
> His eyes not carrying to the equal beam,
> That poises all above."
>
> JOHN DRYDEN

Mollie McMillan was never blind, her eyes carrying "to the equal beam." She saw, over 50 years ago, our profession in its entirety, the great need for it, the devotion and dedicated service it required, of which she was a living symbol.

What did Mollie mean to me as Executive Director and as a physical therapist? I don't believe I can really put it into words. I knew her, of course, before I became Executive Director, not well, but enough to feel her depth, integrity, and compassionate love of her fellowmen. With all this there was her tremendous strength of spirit, which all her life served to overcome more illness, stresses, and trials than most of us ever encounter. How else could she have survived Santo Tomas?

To talk with Mollie was, to me, a tonic. She was so proud of her Association. Never once did she ever show disappointment in our shortcomings. There was always encouragement, praise, and a "thank you" for our efforts even though they seemed to us to be feeble and ineffective. Her picture above my desk in the National Office, smiling and serene, gave me confidence and strength many, many times when I was troubled and insecure.

Another of Mollie's strengths was her great sense of humor which kept everything in balance. Life couldn't be grim when you talked with Mollie. She would dispel one's concern by telling of her experiences—with a twinkle in eye and laughter in her voice. You were immediately bolstered up and ready to go ahead with what you knew all the time was to be done.

I think the World Confederation for Physical Therapy was almost as dear to her heart as the American Physical Therapy Association. She took great joy in its development. This was a special link between us, a common bond, for she was first President of the Association and I was her counterpart in the World Confederation. That she couldn't go to Paris was heartbreaking to her and to all of us who knew how much she had hoped to be there.

As I said in the beginning, I can not put into words what Mollie meant to me, I do know that her vision, wisdom and deep understanding must remain with us and guide us always.

MILDRED ELSON
Executive Director, APTA 1944-1956

Of the 36 years I knew her, the earliest years now seem to stand out impressively. It was not as the teacher or as our Founding President that I first knew her, but as President of the Massachusetts Chapter in 1923. To be sure, we were all still pioneers in our field, but with wisdom and foresight she had launched us forth with great confidence in our future. As a professional leader she had the unusual faculty for inspiring courage and confidence in those of us to whom she "threw the torch."

It was my experience, and privilege, as a young and very new member, to succeed her as President of the Massachusetts Chapter in 1925, and it was entirely upon her never failing encouragement and support that I depended. In those early years, when we were handicapped by having few members and few years of experience as a professional organization, we sought ways and means for obtaining legislation and for standardizing physical therapy preparation. In committee meetings she always had the grace and tact to meet and talk with those whose point of view she might not share, but whom she felt had something to contribute for discussion.

It was in 1925, when Dorothea Beck was our President, that "Mollie" took me "under her wing" when I attended my first national conference, held in Atlantic City. After this her years in China interrupted our contacts except for occasional letters and her brief furloughs at home.

Then from 1946 on—our more personal friendship began when we travelled a bit together and seemed to exchange more personal reminiscences, but always sharing our physical therapy interests.

When one spends sunny hours on deck, or in a garden, with chairs drawn close for sharing reading, for comparing experiences, or for just quiet, general talk, one finds the secret of a personality, such as hers, that is hard to define. One conversation I shall never forget. I had become discouraged and felt I should make a change, asking her advice, and saying I had taken to heart Matthew, Chapter 7, verse 1—"Judge not, that ye be not judged"—knowing there were always two sides to consider. Instantly she answered, "Yes, my dear, but there is also verse 7—'Ask, and it will be given unto you'"—and most surely a way did come.

She had great faith. She held no resentment of bitter experiences and met illness with great courage and reserve. This undoubtedly came from the great spiritual strength she gained from reserving a portion of each morning for reading of the Bible; always excusing herself, she would "withdraw apart to rest awhile."

EDITH MONRO
Sixth President, APTA

"She was a remarkable woman who will go down in history as the 'Mother' of physical therapy in the Army; and as the founder of the American Physical Therapy Association."

EMMA E. VOGEL, COL. U.S. Army Ret.
Reconstruction Aide, World War I
Charter Member APTA
First Chief, Women's Medical Specialist Corps

"And with all physical therapists I mourn her loss.—There is especially a warm glow when we think of her spirit, her knowledge, her leadership, and her friendship."

HAZEL E. FURSCOTT
Reconstruction Aide, World War I
Charter Member APTA
Fifth President APTA

"A wonderful teacher, a wonderful woman whose name will live on for many, many years, because she saw a need and did something tangible about it."

MARGUERITE IRVINE
Reconstruction Aide, World War I
Charter Member APTA
Fourteenth President APTA

"What a great gift Mary McMillan has been—and is—to all of us who have known her personally and professionally; her life and work continue a challenge."

RUTH BABB
Reconstruction Aide, World War I
Charter Member APTA

"She was a very marvelous combination of seriousness and fun. Very truly her life was given to the care and love of her fellow beings and the dear Lord must have a very special niche for her in His Kingdom."

EMILY GRIFFIN
Reconstruction Aide, World War I
Charter Member APTA

"I wish every P.T. could appreciate how much her life has meant to the profession and to every one of us. We can be proud that our profession was organized by one with the high professional standards which Mary McMillan possessed and practiced.—It always distresses me when I find a P.T. who doesn't know of Mollie McMillan."

GERTRUDE BEARD
Former Director, School of Physical Therapy
Northwestern University
Former Editor *Physical Therapy Review*
Fourth President APTA

"Her inspirational appearance before our students, members of their families, friends, and college faculty will live in the hearts of all."

ADELAIDE L. MCGARRETT
Physical Therapy Director
Sargent College
Boston University

"She was one of the most stalwart pioneers of physical therapy in the U.S.A. but her influence spread far wider and we in this country share in your sorrow and are proud that her early training was taken here and that she continued throughout her life to take an interest in our progress."

M. J. NEILSON, Secretary
Chartered Society of Physiotherapy

"Although many of us did not have the privilege of knowing her personally, we do know of her dedication and contributions to the advancement of a profession so important to the welfare of crippled children and adults. She was beloved by physical therapists in the nationwide Easter Seal family and we would like to honor her memory by sending a modest contribution to the Physical Therapy Fund."

DEAN W. ROBERTS, M.D.
Executive Director
National Society for Crippled
Children and Adults

"My association with her was personal rather than professional.—Two characteristics which I especially associate with her were her sincere interest in the welfare of others and her delightful sense of humor which enabled others as well as herself to face difficult situations."

RUTH W. DEAN
Seattle

Southern California Chapter

Our Association and all professional physical therapists lost a champion and great friend when Mary McMillan, "Mollie," passed away in Boston on Saturday, October 24. Many of us who had been privileged to know Mollie, or even to hear her speak, learned to understand what a priceless contribution she made to our profession. Her whole lifetime was full of confidence, loyalty, and vision as to what we should stand for and might accomplish.

Starting with her entry to the profession which she studied in England prior to World War I, and before there were P.T. courses in America, right up to her inspirational words at the 1958 APTA banquet in Seattle, Mollie was a leader and a source of strength.

As many of you know, she organized one of the first courses in physical therapy in this country at Reed College, Oregon, during World War I. She helped organize the APTA and became its first president in 1921. Her book, *Massage and Therapeutic Exercise*, published in 1921 was the first and only comprehensive text on physical therapy written by an American physical therapist.

She took physical therapy to China-Union Methodist College at Peiping—and consequently suffered the rigors of internment during World War II. Mollie was one of the first and most generous subscribers to the Physical Therapy Fund.

It is therefore an understanding request by her family that, in lieu of other expressions of respect and affection, memorial contributions should be made to the Physical Therapy Fund.

Because of what she and her early colleagues envisioned and worked for in the profession every one of us is deeply indebted to her. Those of us who knew her will miss her immeasurably; all in her chosen profession will somehow share the loss.

Massachusetts Chapter

The physical therapy profession lost a most valued and loved member when Mary McMillan died on Oct. 24, 1959.

Mollie, as she was affectionately known to her friends, served her chosen profession devotedly and unselfishly. The training of Reconstruction Aides in World War I, many years of work in China, the publication of a book on massage, and heroic service to the prisoners of war at Santo Tomas in the Philippines are but a few

of the many splendid accomplishments that Mollie is known for.

To the end, Mollie maintained a keen and devoted interest in physical therapy and in physical therapists.

New Jersey Chapter

Those of us who began our professional careers in the early years of the development of physical therapy owe so much to Mary McMillan —this we pass on to all of you who now belong to the American Physical Therapy Association of today, an internationally known organization of widespread reputation and influence.

Her foresight, born of imagination, supported by her undaunted courage and hope, and her insistence upon the highest ideals for professional training and ethics, brought a group of scarcely 300 into our present organization of 8,915 members, as reported at our Annual Conference of 1959.

There have been headaches and heartaches for all who held the reins of administration over the years, but Mary McMillan's personal encouragement and expressions of confidence in us have led us ever onward.

One of our former presidents, on learning of our loss, wrote to me—"It seems like the closing of an era in physical therapy for those of us who knew her." Let us, in the era that lies ahead, dedicate our professional loyalty to the memory of one whose lighted torch shall never grow dim.

EDITH MONRO

New York Chapter—*Greater New York District*

Mary McMillan, founding president of the APTA, died recently at her home in Boston. The District joins with all members of the Association in mourning the loss of a great physical therapist, a great leader, and a great person. Our tribute must be to nourish the ideals of service that her life reflected.

Pennsylvania—*Eastern District*

We are saddened to hear of the death of Miss Mary McMillan, the first president of the Association. Miss McMillan was a gracious and inspiring personality. Her contribution to the field of physical therapy is unmeasurable and she is one whose life depicted the saying "Live each day to the fullest for you will never pass this way again!"

A Tribute from the Council of Physical Therapy School Directors

Mollie McMillan was one of that dedicated group whose fine standards and broad vision served as a stimulus for the founding of the American Physical Therapy Association and the establishment of standards in physical therapy education. Her death in October came as a great shock to the members of the Council of Physical Therapy School Directors as it had seemed that she would be with us always, as her guiding spirit surely will be.

At the first convention of the "American Physiotherapy Association" in 1922. Mollie concluded her President's address with this sentence, "We are now united to be of service in establishing our profession, to be instrumental in formulating a standard, and then to assist in maintaining such a standard." Each year the Council of Physical Therapy School Directors meets to discuss these things as they relate to the education of physical therapists.

We are proud to think of Mollie McMillan as an honored contributor to this specialized field of education. Her enthusiasm for the growth of this profession was with her to the very end. Her lifetime of devoted and inspiring service to physical therapy is our legacy.

From the December 1959 Issue of *Physiotherapy*

"It is with deep regret that we record the death of Miss Mary McMillan, the first President of the American Physical Therapy Association, at the age of 79. Born in the United States, she was educated and received part of her physiotherapy training in this country. She worked in Liverpool from 1911 to 1915, after which she returned to the U.S. and held various professional and teaching posts, becoming Director of physiotherapy courses for graduates of Harvard Medical School. She then spent more than 10 years as chief physiotherapist at Peiping Union Medical College and became a prisoner of war in Japanese hands.

"In lamenting the death of one of the pioneers of the profession, members of the Chartered Society will wish to send a message of sympathy to the American Physical Therapy Association."

Courtesy Armed Forces Institute of Pathology

Mary McMillan at the head of "her troops," WRGH, 1919

First Army Physical Therapist

Physical Therapy as an organized service in the hospitals of the Medical Department of the United States Army had its beginning in World War I, as an important phase of the physical reconstruction program. As medical officers, oriented to the value of physical therapy in Army hospitals, returned to their practices after the war, this specialty had its beginning on a broad scale in civilian medicine.

The magnificent accomplishments of physical therapists during World War I were due in a large measure to the vision, guidance, and direction given by several persons, chief of whom was Mary McMillan. Her enthusiasm for this new profession was boundless and infectious, and the influence and inspiration she extended to those who were fortunate to have been closely associated with her will live for years and years to come.

When Miss McMillan reported to Walter Reed General Hospital, Washington, D. C., as the first physical therapist in the Medical Department of the Army she became the "Pioneer Bluebird." At that time, the physical therapy program consisted only of a small hydrotherapy section which had been operated by enlisted personnel for several years in two small basement rooms. Since no one on the medical staff knew anything about physical therapy as such, it was her responsibility to "sell" physical therapy. She had no treatment space allotted to her, so she devoted all of her time administering bedside treatments consisting of massage, "baking" as it was then called, and hot fomentations. As the value of this treatment became known around the hospital, she was finally allotted working space in a sun porch on one of the wards. This was where Army physical therapy was born, and Miss McMillan came to be known as "The Mother of Physical Therapy" in the Army.

In April 1918, she had the supreme satisfaction of getting physical therapy established in the first organized physical therapy department in the United States Army at Walter Reed General Hospital, in fact she assisted in making plans for this new building. It was a large U-shaped building surrounding a swimming pool. The clinic proper consisted of a well equipped gymnasium, a large treatment room containing about 30 plinths and many types of heating and electrical devices, a large hydrotherapy section, several small treatment rooms and administrative offices for the medical officer and Miss McMillan. Here she worked faithfully, enthusiastically and untiringly, establishing administrative and treatment procedures and assisting the medical director of the department (Major T. M. McFee) in giving short courses for the medical officers. Miss McMillan's enthusiasm and her strong belief in the value of physical therapy and her determination to establish and maintain high professional standards helped to lay a strong foundation for this new form of treatment. Soon the department attracted much attention and was visited not only

by Army medical officers but doctors from all over the country as well.

There were some medical officers, however, who were skeptical concerning the values claimed for these new treatment measures, but reconciled themselves to this "intruder" in the medical profession thinking that it was only a passing fad which would be discarded after the hospitalization of the World War I wounded had been accomplished. In fact, some medical officers were so incredulous that the only patients they would entrust to the care of the physical therapists were those whose condition could not possibly be impaired by the application of physical therapy procedures. It was interesting to observe the change in attitude from indifference and sometimes even open hostility on the part of some of the medical staff to one of acceptance and hearty cooperation. This was due in a large measure to Miss McMillan's outstanding ability and her warm personality.

In June 1918, at the urgent request of the President of Reed College, Dr. W. T. Foster, Portland, Oregon, The Surgeon General of the Army granted Miss McMillan an extended leave of absence to assist in the emergency physical therapy course to be given there. Arriving at Reed College, she found over 200 women eagerly waiting to get started on the course which would qualify them to be appointed as physical therapists in the Medical Department of the Army. Miss McMillan remained at Reed College for the second course which had an enrollment of approximately 60. At Reed College, she was the instructor in massage and was Director of The Reconstruction Clinic which was established for practical experience in the actual treatment of patients who were referred by doctors in the Portland area for treatment on a no cost basis. The enrollment at Reed College for the first course was the largest of any of the colleges which offered emergency physical therapy training courses and was the only one offered in the West, and so far as is known the largest in the country since that date. Those who graduated from these courses were inspired and dedicated to the job of turning out a performance of which Miss McMillan would be proud.

In February of 1919, Miss McMillan was assigned on temporary duty to US General Hospital No. 24 near Pittsburgh to organize and establish another physical therapy department, and after several weeks there she returned to Walter Reed Hospital to be informed of her promotion to Chief Head Reconstruction Aide. The peak load of the physical therapy program occurred in the first six months of 1919.

After her promotion to the grade of Supervisor on Oct. 16, 1919, Miss McMillan spent only half of her day at the hospital; in the after-

Courtesy Armed Forces Institute of Pathology

Mary McMillan with physical therapists and physicians, WRGH, 1920

noon she acted in an advisory capacity in the office of The Surgeon General on matters pertaining to the inactivation of physical therapy departments and the discharge of physical therapists. It was while she was still on duty at Walter Reed General Hospital, that Miss McMillan wrote letters to all Army physical therapists who had returned to their civilian activities, soliciting their opinions as to the feasibility of establishing a national organization to promote standards of ethics and training for this fast growing profession. Her idea was enthusiastically supported and thus the World War I physical therapists headed by Miss McMillan became the charter members of the American Physical Therapy Association.

Speaking of the World War I physical therapists, the late Dr. Frank B. Granger, who established and directed the physical therapy program in The Surgeon General's office during World War I, made the following statement: "Their loyalty, their enthusiasm, their painstaking care, their professional ability and their personality were not only mighty factors in raising the morale and hastening the treatment of the wounded in Army hospitals, but also in proving to the too often skeptical medical officer the value of scientifically applied physical measures." This was the influence of Miss Mary McMillan.

It was my good fortune to have been a student in the first course given at Reed College, Portland, Oregon, in 1918 and to have been selected by her to be an assistant instructor in massage for the second course there. Later I had the good fortune of being assigned under her supervision at Walter Reed General Hospital, Washington, D. C. Whatever success I may have achieved in the Army Physical Therapy Program since that date was due to the inspiration of Miss Mary McMillan.

EMMA E. VOGEL, *Colonel, U. S. Army Retired*
Supervisor of the Physical Therapy Department, Walter Reed General Hospital—1920-1942 and of the Physical Therapy Training Course 1922-1942. Director, Physical Therapists in the Army—1942-1947. Chief, Women's Medical Specialist Corps (Dietitians, Physical Therapists, and Occupational Therapists) 1947-1951.

Courtesy Armed Forces Institute of Pathology
Mary McMillan and Lt. Fletcher—1920

U.S. Army 1918-1920

1918 Appointed the first physical therapist (then known as Reconstruction Aides) in the Medical Department of the US Army, reporting for duty at Walter Reed General Hospital, Washington, D. C. on 23 February, 1918.

1918 Promoted to the grade of Head Reconstruction Aide—5 March, 1918.

1918 Granted leave of absence without pay and allowances to go to Reed College, Portland, Oregon from 25 June, 1918 to 15 Sept., 1918 —later extended to 31 January, 1919. Here she was the instructor in massage and Director of The Reconstruction Clinic. In a telegram from the President of Reed College (Dr. W. T. Foster) to The Surgeon General of the Army requesting this extension, Doctor Foster said, "Requesting extension of leave of absence for several months. Only woman on Pacific Coast competent to train aides in massage for military hospital duty. Miss McMillan in full charge of Reconstruction Clinic just opened. Miss McMillan absolutely essential for this work."

1919 Returned to Walter Reed Hospital, Washington, D. C., 30 January, 1919 after completion of second course at Reed College, Portland, Ore.

1919 11 February, 1919, reported for temporary duty at US Army General Hospital No. 24,

Parkview, Pennsylvania near Pittsburgh to organize newly established physical therapy service.

1919 Returned to Walter Reed General Hospital 4 April, 1919 and almost immediately promoted to the grade of Chief Head Reconstruction Aide. In this capacity, she made several trips to other Army hospitals, inspecting physical therapy activities and conferring with hospital commanders concerning the program. (This being official duty, in addition to her authorized salary, she received $4.00 per day up to 30 days, and $1.50 per day thereafter.)

1919 16 October, 1919, promoted to the grade of Supervisor of Reconstruction Aides. Spent the morning at Walter Reed Hospital and in afternoon, went to the office of The Surgeon General of the Army to assist in the deactivation of physical therapy departments and the discharge of physical therapists.

1920 Resigned her position as Supervisor of Reconstruction Aides on 30 June, 1920. Following her resignation, she received a letter from The Surgeon General over the signature of Colonel C. C. Whitcomb, expressing appreciation for her faithful performance of duty.

Provided by Emma E. Vogel, Colonel U.S. Army Retired, from her personal files and the files in the Office of The Surgeon General.

Physical Therapy Curriculum—1918-1919

Reed College Record

Number Thirty-two: November 1918

The schedule for the second course follows. The next course will be extended to cover four months.

	HOURS
Anatomy-Theory	38
Laboratory	61
Physiology-Theory	16
Laboratory	16
Massage-Theory	38
Laboratory	74
Hydrotherapy	4
Electrotherapy	6
Remedial Exercises-Theory	33
Laboratory	33
Pathology	26
Kinesiology	6
Psychology	10
Hospital Management	2
Emergency Treatment and Bandaging	23
Personal Hygiene	3
Ethics of Nurses	2
Surgical Clinic	15
Reconstruction Clinic	163
Developmental Exercises	28
Recreative Exercises	23
Total Hours	620

Mary McMillan Scholarships

Mary McMillan was responsible for the development of one of our first organized courses in physical therapy in the United States, at Reed College in Portland, Oregon, during World War I. Her enthusiasm for service to others and her dedication to the task to be accomplished made her a fine teacher and leader. She made a lasting impression with students and staff who had the privilege of being associated with her in the United States, Great Britain, and China.

Ever thoughtful of others, with anticipations for the growth and development of physical therapy, her generosity is exemplified in her last will and testament. She has provided for the establishment of scholarship funds for students in the field of physical therapy.

As the executors of her estate carry out her wishes, and the representatives of her profession and Association assume the responsibility intrusted to them, the spirit and vigor for improving performance and increasing the availability of qualified personnel will be continued. There will be perpetuation of our heritage from Mary McMillan.

PRESIDENTS

of the

American Physical Therapy Association

Since its Founding

1921 – 23	Mary McMillan
1923 – 24	Inga Lohne
1924 – 26	Dorothea M. Beck
1926 – 28	Gertrude Beard
1928 – 30	Hazel E. Furscott
1930 – 32	Edith Monro
1932 – 34	Margaret Campbell
1934 – 36	Sarah Colby
1936 – 38	Constance Greene
1938 – 40	Helen L. Kaiser
1940 – 44	Catherine Worthingham
1944 – 46	Jessie L. Stevenson
1946 – 48	Susan G. Roen
1948 – 49	Lois Ransom
1949 – 50	Marguerite Irvine
1950 – 52	Mary Clyde Singleton
1952 – 54	Harriet S. Lee
1954 – 56	Mary E. Nesbitt
1956 – 58	E. Jane Carlin
1958 – 61	Agnes P. Snyder

Physical Therapy on Three Continents*

Mary McMillan

Madam Chairman, members of the American Physiotherapy Association. I want to take this opportunity here and now of telling you how grateful I am to the Executive Committee for bringing me here tonight and for giving me the privilege of speaking to you on the Twenty-fifth Anniversary. I look around and wonder how many in this room tonight attended the first physical therapy conference that was held in the Boston School of Physical Education twenty-three years ago. I wish they would stand. (Pause) I see standing one of our early presidents. These are some of the pioneers who have created and helped to maintain the standards of the American Physiotherapy Association for the last quarter of a century.

I have been asked to speak on the establishment of physical therapy in China and in America and of my ideals regarding this. I feel we have gone through the birth pain period in our profession and have come to that period when the birth pains are over, for are we not celebrating today the Twenty-fifth Anniversary of that child? I am going to call this talk "Physical Therapy from the Embryo on Three Continents."

I want to take you back with me to England. Here it was I received my education and my background in physical therapy. After two years in college where I was working toward a B.A. degree I decided to break away, greatly against my family's wishes, to do that which I had wished to do more than anything else in the world for over a year. The Liverpool Gymnasium had been offering a two year course in physical education, or "physical culture and corrective exercises" as it was called. It early became apparent that my interest lay in corrective work; I think I can say my first and last love, for there is no place today where I feel more at home than in a hospital physical therapy clinic. At the completion of the course I felt the need of a better understanding of pathological conditions. I went to London and took some special courses in neuro-anatomy, neurology, and psychology. I returned to Liverpool. My first job was in Children's Hospital, where the usual polio and spastic conditions and scoliosis were present.

About that time England was facing the early days of World War I. About a year or so later, there was a V.A.D. unit from the Liverpool University, to which I belonged, being formed to go overseas. Of course I wanted to go. I was heartbroken to find that my physical examination prevented me from joining the group. My physician strongly recommended that I get away from war work for a while and my family in Boston cabled me to cross the Atlantic. I crossed the Atlantic during the war, in convoy and complete blackout. It was not long after that America got into World War I.

There were two very outstanding orthopedic men in Boston at that time. Dr. E. G. Brackett and Dr. Joel E. Goldthwait, men of high standing, of high reputation, men of action. They were instrumental in forming a reconstruction unit as part of the U. S. Army Medical Corps, because they realized that the American soldiers would soon be returning to this country and would be needing rehabilitation. I received a letter from Dr. Brackett in which he said, "Sir Robert Jones tells me 'you have one of my girls in Boston'" and added that he would like to meet me. Dr. Brackett had been head of the Orthopedic Department of the Children's Hospital in Boston for years. I was in Maine when I received this letter. When I returned to Boston about a week or two later I called and found that he had just left for England on an emergency mission, but had left word for me to see Miss Marguerite Sanderson. Previous to this time Miss Sanderson had been giving corrective exercises in Dr. Goldthwait's office. At this time she was starting the Boston School of Physical Education. I had a very nice interview with Miss Sanderson. She asked me if I would be willing to serve in the Reconstruction Department of the United States Army that was in the process of formation. I packed my bag to be sure and be ready, and eventually I received a telegram from the Surgeon General's Office—I have that first telegram with me tonight and will read it to you. It was addressed to me and this is its content: "Two pioneer aides needed Walter Reed Hospital immediately. Start work, do some teaching. Would you consider when free from present duties—am anxious to get best person. Wire yes or no immediately"—and signed by Surgeon General Gorgas. I hied myself off to Washington without waiting for further word, transportation or travel orders. I reached the Surgeon General's office where Miss Sanderson was in charge of the Reconstruction Department. She took me to the Walter Reed Hospital. That was the beginning of physical therapy in the U. S. Army.

There had been a hydrotherapy plant that was very efficiently run by corpsmen in the basement of Walter Reed Hospital. The U. S. Army Medical Corps knew nothing about physical therapy and I knew nothing about the U. S. Army Medical Corps. Through the kindness of one of the physicians I was initiated into Army ways and learned how to go through Army channels to get the necessary requirements. First I asked for a place to work, for there was no place provided. After some time a sun porch was allotted as a workroom for physical therapy. Then I thought I would show where physical therapy stood, so I had some prescription blanks printed. I made personal calls upon the different department heads and tried to sell physical therapy and to sell

* Reprinted from the *Physiotherapy Review*, 26: (Sept.-Oct.) 1946.

myself—it was a hard job; they had little time for the likes of me.

I was alone at Walter Reed for quite a number of weeks and then I had the good fortune to have Miss Inga Lohne come as the second P.T. buck-private to be sworn into the Reconstruction Physical Therapy Department. Miss Lohne was of Norwegian extraction, an excellent worker, earnest and efficient, and always full of the spirit of enthusiasm! She was our second Association president. How I wish that she could be with us tonight.

Three other P.T.'s followed—Helen Sheddon, Margery Rickok and Josephine Bell. It may interest you to know that Josephine Bell and I had never met from 1918 till we both found ourselves in a Japanese internment camp in Manila following Pearl Harbor and the fall of Manila. We had many pow-wows about Walter Reed days, during the days of our internment in Santo Tomas Camp.

We were very fortunate indeed to have a man like Dr. Frank B. Granger of the Harvard Medical School, a man of high reputation, of genial temperament, of high standing in his profession, come to head the department in the Office of the Surgeon General. I don't know anybody that could have done as well as Dr. Granger, because it was pretty hard for the Army to 'take' us. He made a place for physical therapy in the Army by establishing confidence among his medical confreres. Another very happy assignment was that of Dr. Frederic Cotton, a surgeon of high reputation, who was assigned to the Department of Surgery, but proved to be a great help in boosting physical therapy.

Then a rumor went around that physical therapy was to have a building of its own, and it happened! That was our greatest boost. Dr. Granger equipped the department and gave special courses to medical men.

With the first group to go, Miss Sanderson went overseas as supervisor of O.T.'s and P.T.'s. I want to say that those P.T.'s who went overseas did such a fine piece of work not only in physical therapy but in anything they were called upon to do, that they helped to establish an excellent reputation for us with the physicians and nurses overseas.

The emergency hospitals were being opened very fast and there were not sufficient trained aides to man the departments at this time. I had a caller at Walter Reed, Dr. Everett Beach. Dr. Beach, after a day of observation in the department, asked me if I would be willing to go to Reed College, Portland, Oregon, as instructor. He said there were 200 women registered to take the special emergency course to prepare them for service. I said that I would go where the Army sent me. Several weeks later the President of Reed College sent me a telegram in which he said, "I can get no definite reply from the War Department from my daily telegrams —over 200 women waiting for instruction—can you get release." I went to the Surgeon General's office and said to Dr. Granger, "I received this telegram from Reed College. You know I have expressed no personal wishes of any kind. I left the matter of my release entirely a thing between the War Department and Reed College. I have always said 'I will go where you think will be the best place I can be of service.'" Major Granger said, "I just can't get this release through for you." I said, "Nobody knows better than you how we need physical therapy aides. If the War Department can't make up its mind, I have made up my mind. It may mean my resignation." Dr. Granger said, "Just wait twenty-four hours." The next day I had a message from the Surgeon General's Office that my papers were in order for leave of absence. I found 208 women waiting for me on the campus of Reed College, all anxious to get started on work. Some of these same people are here tonight. At the completion of the course the graduates were distributed in the various hospitals throughout the country. Those girls worked like Trojans. A second course was given at Reed College with only 50 or 60 students. Between courses I was asked by the orders of the Surgeon General's Office to go to San Francisco to see some possible applicants. I was also asked by the University of California to help make out a curriculum for the Department of Physical Education, where an emergency course also was being given to train aides for Army service.

I returned to Washington at the completion of the second course. Shortly after that I went to Pittsburgh where one of the emergency hospitals was started in a former prison. The department of P.T. was located in what had formerly been prison cells.

I believe about this time Miss Sanderson came back from overseas. She resigned not very long after, and later Major Granger also resigned. We had a new chief, Colonel Brooks, in charge of the Reconstruction Department. He came to Walter Reed and requested that I spend some time at the Surgeon General's office to lend a hand, as the emergency hospitals were being closed and it was an entirely new field to him. I suggested I go to the S.G.O. in the afternoons and spend the mornings at Walter Reed. About this time, when the emergency hospitals were being closed, the various types of patients were concentrated in the different Army hospitals.

About the time the emergency hospitals closed I resigned from the Army. Dr. Brackett had said to me some time before, "What are you going to do when you leave the Army?" I said, "I am going back to England." He said, "That's right, but come back to America as soon as you can, because I would like to have you in Boston."

Before leaving Washington, letters were sent out to the physical therapy service aides asking for their opinion—if they would like a national organization to be formed to write in their ideas about it. We had a great many favorable replies from those letters. I do not know what you think, but I think those letters and their replies were the beginning of the National Association, because it was the nucleus of the Army P.T. Aides who were the first to band together to form the American Physiotherapy Association.

While in Boston, Dr. Brackett and Dr. Granger had received letters and I also had received many letters from the physical therapy aides asking for postgraduate work in physical therapy. The assistant dean of the Harvard Medical School was willing to add an additional postgraduate course, No. 442, to provide special emphasis on the request for electrophysics and electrotherapy. For the next nine to ten years I was associated with Dr. Granger as codirector of these courses. Postgraduate Course No. 441 in physical therapy was started during the war emergency and continued. It placed special emphasis upon the care of poliomyelitis.

Then, I think, came one of the most interesting phases of my work. Would you like to hear how I went to China? I happened to be Chairman of the Massachusetts Physiotherapy Association. I received a letter from the China Medical Board of the Rockefeller Foundation. A physical therapist was needed to work in the Peking Union Medical College in China. I said to my brother after reading the letter, "That would be a nice job for somebody," never dreaming I was to be the somebody. A week or two later this letter was read at the Massachusetts Physiotherapy Association. One of the members came to me and said, "I am very much interested." (She was a very fine person.) "Would you be willing to write me a letter of recommendation?" I wrote just as nice a letter as I knew how. Then she said, "Do you think you could find out something about this job?" I went to Dr. Brackett and asked him if he could tell me anything about it. After careful perusal of the letter he replied, "Why don't you go? It would be a wonderful experience." Then he sprang the remark: "I would like you to go to New York this weekend." I said, "I have a lot of engagements this weekend." He then asked his secretary to cancel my professional engagements for Saturday. I went to New York and saw the personnel chief. She greeted me and said with an amused smile, "So you are Miss Mary McMillan." Then she explained, "I have had many letters from different parts of the country and so many have referred me to you." That was very embarrassing for me.

In another couple of weeks I received an official offer to go to China to take charge of the Department of Physical Therapy at the Peiping Union Medical College. I set sail for the Orient and in due time first set foot in Japan, little dreaming that I would have three return trips around the world by every available route, and would spend the last two years as a Japanese prisoner of war behind a barbed, electrically wired fence.

I reached the Peiping Union Medical College in Peking. It is a most unique and beautiful building, constructed of gray stone, in truly Chinese architectural design with the green glazed tiled roof having the rolling upcurve at each corner. The Department of Physical Therapy had a large treatment room and a small treatment room with very antiquated equipment, a well equipped hydro department, and a large gymnasium. But, oh, the apparatus there! It looked like a Spanish inquisition chamber. One of my first tasks was to persuade those in charge to dispose of most of the obsolete apparatus in the gymnasium.

It isn't exactly easy to start work in a country where one knows nothing about the people or their language. I took a lesson in Chinese every day for two years, and tried to learn the jargon of the profession in the Chinese language. The Chinese write, as you know, in quite a reverse way from us. I sometimes imagined that their thinking also was in reverse to ours. Their approach also is in reverse to ours. They do not go 'straight from the shoulder' as Americans are apt to brag about. They take a circuitous route. I think the thing that perhaps helped me in my early days in Peking was these lines— "To get adjusted to the world is, after all, the better plan—it won't adjust itself to you, for it was here before you came." Yes, China had been there centuries before I was there. It was my job to try to adjust myself to China. I had to wait until the Oriental became accustomed to the Occidental and I became accustomed to the Oriental, before I could expect to win their confidence.

I lived in North China—therefore it was the Northern Chinese that I knew best. They are a most likeable people—intelligent, responsive, and with a sense of humor, even if of a different kind of humor from ours! As soon as they feel acquainted with you they are apt to consider and treat you as an old friend. One has to get accustomed to a different tradition in the Orient, therefore a different way of life.

New equipment had to be purchased and most of it had to be chosen from catalogues. Then I realized a change in personnel was necessary. There were persons who had done a fine piece of work according to their knowledge, but they just could not meet the standards that I was working toward in the department. This necessitated that some people must be taken off the payroll—it was not an easy thing to do—it hurt me very much to do it, but it had to be done. I was able to replace these people with more modernly trained nurses and a physical education graduate. That gave much better possibilities for progressive growth. I also was interested that some scholarships in physical therapy were given to college graduates who had majored in some of the basic sciences. Another thing that I felt would be helpful was to have a physician in charge of the department. I was pleased therefore to have one of our own medical graduates interested to study physical therapy with the idea of making it his specialty.

Of course the college and hospital have not been functioning since Japanese occupation. The buildings are at present the peace-truce headquarters, with General Marshall on the middle floor, the Communists on the top floor, and the Nationalist government representatives on the ground floor.

In summing up I want to say that physical therapy has been to me a very full and satisfying life. On three continents I have seen it developed from the embryo to its present state of development—in

Europe, in America, in Asia. Physical therapy has developed and I have not only seen but been in its development.

My last work in physical therapy was in a Japanese internment camp. I have already spoken to you at the last convention of my experience as a Japanese prisoner of war. I will say this—that physical therapy in a Japanese internment camp was the one outstanding joy of that existence—the real joy experienced of service without money and without price, without any equipment, without trained workers, without adequate food to keep the body fires burning—still I am going to say that my work in the Japanese internment camp I consider my "swan song" in physical therapy.

I am going to tell you a story. A girl about 14 was referred for physical therapy from the camp clinic, with a diagnosis of painful tender feet. She was an adolescent girl whose whole appearance registered unhappiness. I tried to get her body in a little better alignment. She came daily for treatments. One day she confided in me. I replied, "I see by your actions and reactions that you are filled with bitterness and jealousy" (jealousy of a young and very beautiful blonde stepmother who seemed to be almost in her teens). I said, "You are a very pretty girl, but you don't look pretty because your face reveals envy and jealousy and bitterness." I explained to her that psychiatrists had proven that these states of mind react unfavorably upon the physical. I said, "There is not much use in working to improve your body until your mental attitude is changed toward life." I then suggested that I needed somebody very badly to help me. She said she would like to do so. Later I was able to find work for her in the children's department of the hospital. She loved children and they loved her. Shortly after that I left Santo Tomas for another internment camp. I wondered many times what had happened to the youngster. About 18 months later when I was aboard the "Gripsholm" a very lovely girl ran up to me and asked, with a sparkle in her eye, "Have I improved any?" I replied, "Natalie, I would hardly recognize you." Then she put her arms around me and with a hug said, "I don't know what I would have done without you."

By that story, what I want to point out is, there isn't a physical therapist here who does not have many chances to do the same thing, even if not in the same way. A physical therapist must have a sympathetic understanding toward her patients, and that doesn't mean a maudlin sympathy. She must know when to let the patient let off steam and when to put in the right word. The physical therapist must be healthy in mind, in body, cheerful, for these things are infectious. A physical therapist should keep up with the latest in her profession so that when new things come along she is aware of them, so that she may be of the greatest service to her patients. She must keep up to date. She must believe in herself, for without this others cannot have faith in her. She must have faith in herself, and that does not mean cocksureness, that all too frequently comes from ignorance. A physical therapist must never let her patients go without hope, and I do not mean false hope either, I mean real hope. Because hope helps to chase away fears. When fears are disposed of it gives a chance for nature's healing and physical therapy aids nature's healing. Of course, it is not always easy. There will be hard knocks. It is the hard knocks that help to bring out best timber in us. Who wants a soft job, anyway? I am going to close with a little poem—

Good Timber

The tree that never had to fight
For sun and sky and air and light;
That stood out in the open plain
And always had its share of rain;
Never became a forest king
But lived and died a scrubby thing.

The man who never had to toil
To hew the wood or till the soil;
Who never had to win his share
Of sun and sky and light and air
Never became a manly man
But lived and died as he began.

Good timber does not grow in ease,
The stronger wind the tougher trees;
The farther sky the greater length
The more the storm the more the strength.

By sun and cold, by rain and snows,
In tree or man good timber grows;
Where thickest stands the forest growth
We find the patriarchs of both;
And they hold converse with the stars
Whose broken branches show the scars.

Association News

Viola Johnson Anderson passed away Sept. 29, 1959 at Temple Hospital, Philadelphia. Mrs. Anderson completed her physical therapy training at Temple University Hospital, Philadelphia, in 1933. Prior to her death, she was employed at the Byberry State Hospital. Mrs. Anderson became an Association member in 1952 and at the time of her death was an active member in the Eastern District, Pennsylvania Chapter.

John Livieri, West Haven, Connecticut, died recently of cancer. A 1958 graduate of the University of Connecticut, he practiced physical therapy only a short time before he became ill. He was an active member of the Western District, Connecticut Chapter.

Mary McMillan's Photograph

In preparation for the Second Congress of the World Confederation for Physical Therapy in June, 1956, Miss McMillan sat for the photograph which appeared in the printed program of the Second Congress and now appears in this issue of the *Review*. As a commemoration of Mary McMillan and her steadfast allegiance to the profession, directors of schools of physical therapy, those in administrative positions, and Mollie's many friends may wish to have a print of the photograph which is suitable for framing. These may be obtained from the National Office at a cost of $1.00 each.

Marriages

Janet Baur, of Cincinnati, Ohio, now Mrs. Janet B. Burbank, Bay Village, Ohio.

Margaret Bushnell, of Bristol, Conn., now Mrs. Margaret B. Laflamme, Bristol.

Judith S. Gordon, of Baltimore, Md., to Robert E. Mendelson, University City, Mo.

Lucille Greteman, of Omaha, Neb., to Patrick J. Tobin, Kansas City, Mo.

Joan A. Jacobs, of Far Rockaway, N. Y., now Mrs. Joan J. Minzer, Far Rockaway.

Karen R. Johnson, of San Francisco, Calif., to Milo N. Illich, San Francisco.

Yvonne Kellner, of Colorado Springs, Colo., now Mrs. Yvonne K. Taylor, Phoenix, Ariz.

Phyllis L. Kraft, of APO New York, N. Y., to Gerald Daniell, APO New York.

Mary E. Lidgely, of Harmarville, Pa., to Joseph D. Kerrigan, Pittsburgh, Pa.

Mary J. Mehrten, of Pittsburgh, Pa., now Mrs. Mary M. Theisen, Greensburg, Pa.

Susan Morsheimer, of North Castle, N. Y., to Robert F. Connolly, Brooklyn, N. Y.

Dolores Shoulders, of Springfield, Ohio, to Dean E. Moore, Champaign, Ill.

Janet Span, of Paterson, N. J., to M. Richard Ball, Plattsburg, N. Y.

Report of the Nominating Committee

On Nov. 19, 1959, the Nominating Committee met at Mineral Wells, Texas, immediately following a meeting of the Council of Physical Therapy School Directors, to select a slate of candidates for the National election in June, 1960. Three directors and two members of the nominating committee are to be elected to serve three years.

In advance of the meeting, it was the privilege and responsibility of the chapters and members to submit names of persons for consideration by the Nominating Committee. Seventy-four potential candidates were suggested by less than one half of the chapters and by two individual members. Consent to serve was received from 57 of those recommended. These members represented 23 chapters. This meant that more than half the chapters denied themselves possible National representation.

After serious study of the expressed wishes of the membership and with due consideration of the individual qualifications for office, geographical distribution, and area of employment, the following slate was formulated:

CANDIDATES

Directors—Three to be elected for three years

Thelma Holmes	Rochester, New York
Louise Reinecke	Chicago, Illinois
Beverly Schaefer	Texarkana, Arkansas
Beatrice Schulz	St. Louis, Missouri
Lola Smith	New Orleans, Louisiana
Barbara White	Gainesville, Florida

Nominating Committee—Two to be elected for three years

Lloyd B. Hanson	Escondido, California
Lenore Krusell	Madison, Wisconsin
Lorraine Paulson	Denver, Colorado
Kathryn Phillips	Warm Springs, Georgia

Nominating Committee

DOROTHY BAETHKE
RUBY DECKER
GLADDES NEFF
VIRGINIA WILSON
BETH PHILLIPS, *Chairman*

New Student Members

Childrens Hospital—Los Angeles

Margaret M. Barry
Carolyn Crofts
Shirley W. Dixon
Sharon J. Ekstrum
Nancy E. Fages
Reiko Fujinami
Marilyn D. Gross
Edward G. Klassen
Francis J. Kuenzig
John J. Nicosia
Barbara K. Sakata
Lael A. Spencer
Clair G. Thomas
Georgeanna J. Ward
Barbara L. Wolk
Janet S. Zaboski

College of Medical Evangelists

William R. Aycock
Bert L. Beiler
Charlotte M. Brantley
Ruth E. Canavan
Margaret H. Cobb
James R. Cruise
Theodore C. Dawson, Jr.
Herbert G. Dinwiddie
Robert L. Geddis
Beth E. Gregory
Billie S. Harmon
Emma B. Hill
James H. Holmes, Jr.
Noreen K. Kawasaki
June J. Kimura
Carolyn M. Little
Oradelle G. Lizer
Eleanor V. Lohr
Robert O. Mitchell
Vernon F. Mulholland
Andrew E. Myers
Marolyn J. Price
Jerry L. Schaumburg
Ralph S. Segoria
Robert G. Stoddard
G. Thomas White
Roy R. Wightman

Columbia University

Susan Colwell

Grady Vaughn School

Sherie A. Bratton
Bobby T. Carrington
James D. Cicero
James C. Dalton
Nancy L. Hall
Sylvia L. Hazel
Henry L. Laird
Joseph G. Mitchell, Jr.
Blanche L. Nunnery
Patsy R. Oxford
Norma J. Stevens
Florent A. Theriault
Pierce E. Watson

Marquette University

Mary R. Siegel

Mayo Clinic

Gail J. Appel
Rodney L. Dodge
Ronald E. Bacon
Lloyd L. Benson
Fredericka Y. Binnom
Findley K. Boyd, Jr.
Gretchen C. Branowitzer
Barbara V. Cantini
Chris T. Chancos
Theodore E. Dashnaw
Nancy A. Egbert
Janet L. Froehlich
Mary K. Hall
Patricia D. Hommel
James W. Marshall
George A. Martin
Joan E. Meyers
Russell K. Mohler
Max L. Morton
Norma J. Petschow
John A. Randall
Marilyn S. Schreiner
Sr. M. Don Bosco
Sr. Mary Jean Clare
Burdetta L. Thrapp
Janice E. Toms
Florence J. Weeder
Peggy L. Wiese
Kora K. Winegarner

New York University

Judith M. Blake
Ronald Gluck
Robert A. Jargowsky
Marilyn C. Mc Kenna
Sr. M. Therese Patricia O. Carm

Stanford University

William D. Flack
Marilyn L. McDonald

United States Army

Cynthia E. Jackson
Mary Lucas
Mary E. Wallace

University of Connecticut

Claudia E. Beach
Barbara A. Bernik
Richard Gamel
Jean F. Martens

University of Iowa

Charles N. Argenta
Richard G. Bachli, Jr.
Claude A. Behrens
Max A. Beyersdorf
Stanley Capper
Leanne R. Clemens
Richard Davison
Johanna Deemy
William A. Deml, Jr.
Mattie Edwards
James B. Elliott
Ronald B. Fairchild
Walter W. Golden
Beverly J. Graef
Robert C. Jaeger
Jean C. Koltz
Robert E. Leonard
Dean P. Oswalt
Rieta J. Peterson
John T. Quick
Harold A. Shanks
Gary Smidt
Mary G. Teegarden
Wayne Vanderlan

University of North Carolina

Julianne Benson
Elizabeth A. Brown
Sylvia A. Gaines
Dorothy D. Hulick
Kenneth W. Jordan
Carol W. Pratali
Barbara L. Stephens

University of Southern California

Richard W. Allsop
David N. Bessie
Piccola S. Butler
Joyce P. Clayton
Jo Ann Cox
Garfield Cremona
Nancy J. Deacon
Marion M. Durbin
Marjorie L. Hoth
Douglas A. Hudgens
Harold Johnson
Catherine Jones
John E. Krogh
Marlene J. Moll
Donald W. Stutzman
James Wishard
Daphne C. Whitelaw
Michitaro Yamamoto

Dedicative Issue

This issue of the *Review* is appropriately dedicated to Mary McMillan 39 years after she initiated the first issue.

Anticipating that physical therapists and physicians may wish to obtain additional copies, these are available from the National Office at the usual cost.

Index to Current Literature

(*continued from page* 88)

TESTS AND MEASUREMENTS

A Method for the Functional Evaluation of Disability. J. Sokolow, J. E. Silson, E. J. Taylor, E. T. Anderson and H. A. Rusk, Arch. Phys. M., 40: 421-428, October 1959

Master Two-Step Exercise Test in Clinically Unselected Patients. A. J. Brody, J. Am. M. Ass., 171: 1195-1198, Oct. 31, 1959

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1960 · CONFERENCE

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of the

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Penn-Sheraton Hotel overlooking Mellon Square

Pittsburgh Points To Progress

Growing Pains . . .

Pittsburgh was born out of a series of events that for interest and excitement equal any in the world; some of these events led to the Revolutionary War. Pittsburgh is still an exciting city, especially in the medical field, and we hope to add a good share to the excitement of our developing profession when you come to Pittsburgh in June. A Conference is not just a program. To miss knowing something about the history of our city we feel would be a regrettable omission. Let us tell you about our past; for only with a keen appreciation of what our heritage has been and the years of struggle can you truly appreciate what is here today.

George Washington first came to this area in 1753 and wrote to the Governor of Virginia: "I spent some time viewing the river and the land in the fork, which I think extremely well situated for a fort as it has absolute command of both rivers." In answer to this a small force was sent out from Virginia to fortify the area. These troops were too late; French traders had won the loyalty of the Indians and with their assistance the French from Canada sailed down the Allegheny, took possession of the point, and built Fort Duquesne. The French flag flew over the Point for the next few years, but British indignation smoldered and an attack was launched in July of 1755. Indian scouts kept the French well informed about British activities. They could hardly have missed the columns of brightly clad British Red Coats maneuvering in orthodox parade-ground fashion. For fear that heavy British ammunition would destroy Fort Duquesne, the French and their Indian allies met the attackers eight miles east of the Point. Backwoods tactics served to route the English in a conflict which shocked the world and proved to the British how ineffectual traditional military tactics were for coping with this new world wilderness. The British General Braddock was mortally wounded, and today the town located on the battle site bears the name of Braddock.

After Braddock's defeat, Col. Henry Bouquet, a Swiss soldier of fortune, adapted the tactics of the Regular Army to meet conditions of wilderness fighting. With ingenuity and foresight the British army slowly built a road through the Allegheny Mountains. The soldiers suffered

and struggled to forge their way through the immense wilderness, overgrown with trees and underbrush. Their determination opened up a gateway never to be closed, that made it possible later for Prime Minister William Pitt to preserve and secure the safety of America. Worried French authorities in Canada were well aware that General John Forbes was approaching with an army of thousands over this new Forbes road; they ordered their men to retreat and demolish Fort Duquesne. The British seized the smoldering ruins at the Point on Nov. 25, 1758. The next day General Forbes sent a message of victory to William Pitt and named their conquest Pitts-Borough in his honor. Forbes was a Scotsman as were many of the soldiers and early settlers. The final "h" of Pittsburgh has remained from the traditional Scottish spelling.

Forbes remained at the scene of his triumph for only one week. Before he left he ordered 200 colonial soldiers to remain and guard the site, under the direction of Colonel Bouquet. Among these were the troops of George Washington. Washington strenuously protested the use of his ill equipped troops for occupation duty. "Our men are in a miserable situation with hardly rags to cover themselves," he wrote to a friend in Virginia. Forbes was adamant and told Washington he had no authority to leave British troops behind. Consequently, Forbes left and took his men back to Philadelphia leaving the colonials to "hold the fort." The incensed Washington impetuously left for Virginia and resigned his military commission. Seventeen years later when Washington led the revolt against the British it could honestly be said that the seeds of discontent had been sown in Pittsburgh.

Colonel Bouquet, it has been said, did more for the city in its infancy than any other person. At his direction Fort Pitt was erected in 1759 for protection against the Indians and as a center of trading. The Fort was a pioneer version of the Pentagon and was surrounded by a stockade. The Indians called it "Menachk-sink" which means "where there is a fence." There were many skirmishes with the Indians which the poorly equipped troops under Bouquet's leadership bravely fought. Chief Pontiac was on the warpath. Fort Pitt and Detroit were the only bastions of white rule left in the vast hostile territory west of the Alleghenies. In 1763 Fort Pitt was besieged for three months; finally Bouquet repulsed the Indian attack at the Battle of Bushy Run. Victory was complete and the last serious Indian menace ended. At this time most of the Indians left the area, but their memory lives in Pittsburgh today. Our rivers, streets and many suburbs retain their names. Their trails became our important highways.

The Blockhouse, built as a redoubt outside of the main walls of Fort Pitt, remains today. From its musket sites a sentry could spot Indians for 500 yards in any direction. Soldiers occupied it until the fort was abandoned in 1785. At this time an addition was attached and it became a private residence until 1890. Mary E. Schenely, whose family owned the redoubt and 23 acres around it, donated it to the Daughters of the American Revolution. In 1892 they founded a Fort Pitt Society of 12 members to take care of the Blockhouse. The Pennsylvania Railroad in the early twentieth century was eager to build a freight yard at the Point and planned to demolish the historic shrine. The women "battled" furiously and the railroad went the way of the Indians, French, and British. In 1907 the Governor vetoed a railroad request for the land and subsequently signed an exemption for certain historical buildings and sites from the railroad's right of eminent domain. Freight yards went up around the Blockhouse and it was virtually buried in the dirt and confusion of modern advances, but when you come to Pittsburgh next June, you will find our Blockhouse properly set as a historic jewel at the tip of the Point surrounded by beautiful Point State Park. You may walk through the lovely gardens and visit this symbol of American tenacity.

Roads built by the British and the rivers made the city a natural gateway to the west. Packhorses, stagecoaches, and Conestoga wagons brought the first settlers. These were later replaced by railroads, steamboats, and flatboats. We soon became the industrial and commercial center of westward expansion. The permanent plan for the city was laid out by George Woods in 1784. It included the area known today as the Golden Triangle; even then Pittsburghers had to reconcile themselves to narrow streets and therefore the city has grown vertically. Within six years the town had a market place, post office, the first newspaper west of the Alleghenies, a court, five stores, a Presbyterian church and minister, a columnist, and two "gentlemen of the medical faculty." The rugged frontier outpost was described as "wickedness to excess—no morality or regular order." Whiskey was almost the only money product. "Taverns were more plentiful than churches and whiskey purer and stronger than any faith." It has been said that for a century Monongahela Rye was famous all over the country for giving more miles to the gallon than anything since the invention of distilling.

The rivers, a great natural resource, had brought civilization and created a valuable site for trade and travel, but later proved to be a menace. Terrible floods plagued our shores from earliest times bringing death and destruction. The most disastrous flood occurred on St. Patrick's Day in 1936. Thirty-six people lost their lives, and property damage soared to well over a hundred million dollars. To prevent recurrence of future havoc, Pittsburghers persuaded the federal government to set up a network of 10 major dams near the headwaters of the Monongahela and Allegheny rivers. Floods no longer plague us.

The second great natural resource which set the stage for our growth as a center of industry was the large deposits of coal, ore, and limestone. Industry, however, brought with it the problems of smoke, dirt, and slum areas. Pittsburghers always thought their prosperity was proportional to the smoke and dirt; then, two hard hitting ordinances regulated the density of smoke and reduced the total smoke by 90 per cent and heavy black smoke by 98 per cent. Conquest over floods and smoke sparked a new civic enterprise. Acres of slum area have been demolished and county wide improvements costing a staggering two billion dollars are near completion.

At our birth in 1758 we were challenged by the expansion of new horizons. In present times we have been confronted with the community challenge to turn an ugly, decadent metropolis into a magnificent, dynamic city. We have been described as a city that changed from unbelievable ugliness to one of shining beauty in less than half a generation.

You must come to see the striking, colorful city that has emerged from such a chaotic history. Pittsburgh will always be associated with industry, so where could we find a more fitting place to examine the role of the physical therapist in industry. Our city is no different from yours in the industrial picture—except possibly in magnitude—we still have major problems in the rehabilitation of the injured worker. But we also see physical therapy as a profession which can play a key role in industry. Our exploration of this problem at the Conference in June we hope will add another bright chapter to Pittsburgh's historical and medical progress.

Pa Pitt's 202nd!

Pa Pitt celebrated his 200th anniversary in 1958 and by the time you come to Pittsburgh he will be 202 — a "bicentenarian" who would put octogenarians to shame. To what does Pa ascribe his longevity? Without making his story 200 years long Pa told us one of his secrets.

One of Pa's beliefs was that he must keep on learning—and must be alert to opportunities. As a young man he started at the bottom; his first job was in a steel mill and it wasn't easy. Pa developed a strong back and all went well until he got promoted to the job of timekeeper. This, to Pa, was a soft job and he softened, too. Then his back and legs began to ache and shooting pains disturbed his sleep. Pa's doctor told him to get more rest but this didn't help. Pa was miserable and his boss threatened to fire him. There was no union in those days and Pa knew he had to get better or lose his job. Pa was no ordinary man and he finally figured it out for himself. What he needed was more exercise! From that day on, in whichever job he did, he varied his activity by exercising—he even got some of the fellows to join him in his routine. One day he went back and told his doctor what had helped him and "Doc" said, "That's good, Pa! It would be a fine idea for more of my patients to do the same thing." So Pa is still keeping mighty active and considering his 200 years he's in quite good shape. All of the people in town are proud of him!

We all know that what Pa needed was some good physical therapy. Pa is just one example of how physical therapists can help the worker to stay on the job or get back to the job faster. But we physical therapists need to adopt some of Pa's attitudes if we are really going to help; we too, must recognize opportunities and decide what to do about them.

Well, by now Pa has known about physical therapy for almost 40 years. He's been watching Pittsburgh grow for 200 years and has seen some big changes take place. He says there is no place like Pittsburgh for physical therapists to really find out about how they can help industry. He

says, too, that industry needs to know more about physical therapy and that physicians who are responsible for treating the ill and the injured want to know more about what physical therapy has to offer their patients.

Pa wants every physical therapist to open his eyes and his mind and realize that you don't have to work in a plant or factory to be working with industry, labor retirement and welfare funds, management health plans, workmen's compensation, and many kinds of insurance companies. He thinks some physical therapy is pretty expensive; that is, he says that the kind of treatment some people call "routine" isn't worth the money. He says it's up to physical therapists to use their heads as well as their hands. Otherwise how can they help physicians to do their best for the patient? He even believes physical therapists should be able to help an employer find out if a man is suited to a job, or a job to the man. Furthermore, Pa thinks that all physical therapists treat a lot of patients whose bills are paid by someone else, and that all physical therapists need to know more about these things.

Pa says his days aren't over by any means and that yours are just beginning! Almost 20 physical therapists, at least 10 physicians and several other experts in the field will have it ready for you. "Come to Pittsburgh and get it!" says Pa Pitt.

2,500 Can Drive In A Day!

For the first time in several years, the Conference site will be readily accessible to at least one third of our active membership. For many members, the 1960 Conference will be their first; for others, it may be the twenty-first! First or twenty-first, the Pennsylvania Chapter through its Western District plans to make it the best! All members east of the Alleghenies should plan to meet their western friends at the Gateway to the West! Freeways, toll roads, turnpikes, and superhighways will lead you to Pittsburgh! Why not form a car pool with several of your friends and bring them to the Point in Pittsburgh?

Barbershop Quartet Competition

Hi P.T.'s young and gay—
Ope your mouths and gently bray
Lift your spirits and don't be thrifty;
Come to Pittsburgh in 1960.

Sing—sing—sing

For years great talents have gone unheard behind closed doors when, at every conference our members huddle around a cauldron of brew and enjoy hours of singing. Here is your golden opportunity to burst forth and share with all these good times. A Barbershop Quartet competition is planned for the members of the APTA during the Sunday evening Opening Reception of the 1960 Conference. Get at least one quartet lined up in your chapter or district—Eastern Pennsylvania District has already challenged Western. We need lots of competition!

Warm up your vocal cords—get squared away with your quartet and let Pa Pitt hear you sing in the Golden Triangle.

Section on Education

The annual meeting of the Section on Education will be held on Sunday, June 26, 1960 at the Penn-Sheraton Hotel in Pittsburgh. The general subjects to be discussed at this year's all-day meeting are graduate education and student counseling. A noon luncheon is planned preceding the business meeting.

Membership in the Section on Education is open to members of the American Physical Therapy Association who are associated with educational programs. Thus, membership is open to supervisors or staff members of clinical training facilities, faculties of approved schools, consultants to agencies concerned with public or professional education relating to physical therapy, and those who are affiliated with facilities giving short term, in-service, or postgraduate courses. Applications for membership may be obtained by writing:

Mildred Heap, Treasurer
Section on Education
University of Buffalo
2183 Main Street
Buffalo 14, New York

Original Papers for Conference

Members of the Association who have been working on special projects related to physical therapy procedures—research, clinical or laboratory; reviewing results achieved with a group of patients; adaptation or application of new methods of treatment; or any other subject which will advance the profession—should plan now to report their work in Pittsburgh next June.

Two copies of manuscript, typed (double spaced), should be submitted to Dorothy E. Voss, Editor in Chief, *Physical Therapy Review*, by Apr. 1, 1960. The *Review* Editorial Board will select papers to be read by members and has the prerogative of publishing those papers selected. Members will be notified of the Board's decision not later than April 25.

SHORT TERM COURSES FOR GRADUATE PHYSICAL THERAPISTS

Title of Course	*Sponsor of Course*	*For Details Contact*	*Dates of Course*
Cerebral Palsy	The North Carolina Cerebral Palsy Hospital Durham, North Carolina	Dr. Lenox D. Baker Medical Director No. Carolina C. P. Hosp. Durham, North Carolina	Courses arranged according to individual need—duration 3 months
Physical Therapy in the Care of Neuromuscular Disease	Georgia Warm Springs Foundation Warm Springs, Georgia	Robert L. Bennett, M.D. Medical Director Ga. Warm Springs Found. Warm Springs, Georgia	January April October
Technics of Neuromuscular Reeducation	California Rehabilitation Center Vallejo, California	Margaret Knott, Chief P. T. Calif. Rehab. Center Vallejo, Calif.	January 1 April 1 July 1 October 1
Functional Bracing of the Upper Extremities	U. of California and U. S. Office of Vocational Rehabilitation	Prosthetics Education Program Rm. B4-229, Medical Center University of California at Los Angeles 24, California	June 13—17, 1960
Upper Extremities Prosthetics	Postgraduate Medical School & College of Engineering New York University	Prosthetics Ed. Program New York University Postgrad. Medical School 550 First Avenue New York 16, N. Y.	May 31—June 10, 1960
	U. of California and U. S. Office of Vocational Rehabilitation	Prosthetics Education Program Rm. B4-229, Medical Center University of California at Los Angeles 24, California	May 9—13, 1960
Lower Extremity Prosthetics	Postgraduate Medical School & College of Engineering New York University	Prosthetics Ed. Program New York University Postgrad. Medical School 550 First Avenue New York 16, N. Y.	Apr. 18—29, 1960
Above-Knee Prosthetics	Northwestern U. and U. S. Office of Vocational Rehabilitation	Director of Prosthetic Education Northwestern U. Med School 401 E. Ohio St. Chicago 11, Illinois	June 20—24, 1960
Below-Knee Prosthetics	U. of California and U. S. Office of Vocational Rehabilitation	Prosthetics Education Program Rm. B4-229, Medical Center University of California at Los Angeles 24, California	Feb. 29—Mar. 4, 1960 April 4—8, 1960
	Postgraduate Medical School & College of Engineering New York University	Prosthetics Ed. Program New York University Postgrad. Medical School 550 First Avenue New York 16, N. Y.	Mar. 17—18, 1960 Apr. 7—8, 1960
	Northwestern U. and U. S. Office of Vocational Rehabilitation	Director of Prosthetic Education Northwestern U. Med School 401 E. Ohio St. Chicago 11, Illinois	March 7—18, 1960 May 9—20, 1960
Treatment for the Cerebral Palsied	Children's Rehabilitation Institute for Cerebral Palsy Reisterstown, Maryland	Christopher H. Wiemer Executive Director Children's Rehab. Inst. Reisterstown, Maryland	April 4—June 17, 1960 July 5—Sept. 16, 1960 Oct. 3—Dec. 16, 1960
Principles and Practice of Geriatric Rehabilitation	Dept. of Phys. Med. & Rehab. New York Med. College-Metropolitan Hospital Center	Dr. Jerome S. Tobis Professor & Chairman Dept. of Phys. Med. & Rehab. New York Medical College 1 East 105th Street New York 29, N. Y.	April 25—May 6, 1960

Education

*This Is Your Life**

Sister Mary Ellen Lawley, C.S.J.

Sometime ago, during a conference with a student physical therapist, I asked this question, "Are you happy here at St. Francis?" Her reply was not what I expected and for a moment it startled me. "Yes," she replied, "it is so different here." I smiled as I said, "Different?" "How is it so different?" She hesitated, "I don't know how to express it—everyone is so friendly and kind," and as she looked up said, "Is it because the Sisters are dedicated to their work?" What a beautiful tribute that student gave us: As I pondered over her statement, I wondered why a dedicated life is so frequently associated only with the religious. I like to believe that all those who care for God's suffering and afflicted are truly dedicated people, not only to the sick but to those who will be taught to care for them.

What about the life of a supervisor? Her life is indeed a dedicated one. She must continuously give herself to those assigned to her care. She knows that the objective of the department is to give service to the patient, the hospital, and the community which it serves. She has the duty to see that a good relationship is maintained between her staff and the hospital personnel and that there exists a mutual understanding and respect for one another.

The focus of administrative function is people —people who work for you or are directly or indirectly supervised by you. You exercise administrative skills in getting cooperation from members of the staff and other hospital personnel. Administrative skills are involved in scheduling work. Properly planned work schedule provides for people, work and equipment at the proper time and place, thus making working relationship harmonious and productive. These skills include the fulfillment of such functions as, developing staff policies, selecting, training, guiding, motivating personnel to work to the best of their ability; scheduling and evaluating their work, and ironing out misunderstandings and inconsistencies that develop. Employees are human beings and should be treated with respect even in their mistakes. There is a kind but firm way of correcting people and a greater loyalty is shown to the person who is self controlled and just, when correcting.

One of the most difficult of all administrative functions, is the evaluation of oneself, of one's own performance, and of the performance and potential of one's staff members.

Good service to the patient is a result of good administration and a satisfied, efficient staff. Personnel need to know that they are doing a good job if they are to be happy in their work. A sincere word of praise for a task well done will provide incentive for a continual high quality of performance.

A supervisor must possess information relative to the patient, his diagnosis, his prescribed treatment, and his condition at the time of referral. Doctors look to the supervisor for information on the patient's progress during the course of treatment in the department. Much is expected of today's supervisor who is "bogged down" by numerous duties and functions. A good supervisor learns quickly that if she is to function to her full capacity, she must have excellent communications between herself and the staff members. If she is not a good communicator, dissension among her associates will increase and confusion will reign. Therefore, she must know what communication is and how good communication can best serve her need and the needs of her staff.

Communication is the act of transmitting facts, feelings, and meanings by words, gestures, or other actions.[1] It is a language of symbols, verbal or nonverbal. Communication is not only the act of transmission and reception—not only words—but most important the meaning behind the words. Communication is complicated by individual differences, motivations, meanings, and

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* Presented at the Supervisors' Conference, Physical Therapy Education Through Clinical Experience, Chapel Hill, North Carolina, Oct. 30, 1959.

other problems of human interaction. It is an indispensable device for developing effective working conditions in a department; a most necessary tool in our conversations, in our understanding and dealing with others, in teaching, interviewing, and group problem solving. It is all of these things, since our daily activities are made up of sharing ideas and information. Communication goes beyond departmental functioning because it crosses departmental lines and serves to bind together all departments and services. The essence of communication is the ability and the willingness to listen and to understand the interest and concern of others.

Today's supervisor must be a good listener. She must know how to listen and when to listen. Listening is the process of attaching meaning to what we hear. It is one of the most important and most neglected skills of communication. Listening demands not only the explicit meaning another person is expressing, but also the implicit meaning, unspoken words, and undertones that may be more significant.[2] Listening is by no means an easy process. It is affected by many variables thus making it more difficult. Listening requires skill and effort. It is fatiguing because we *must willingly* give our constant, undivided attention to it. We must *want* to *listen*, *want* to understand how the person with his problem is looking at the world. We must have an earnest intent to be with that person, with respect to his thoughts, feelings, and attitudes. Listening is the vital link in communications and yet we are told it is the weakest link because we are poor listeners.

In 1929, Dr. Paul T. Rankin,[3] formerly Supervising Director of the Detroit Public Schools, studied the activities of adults in various occupations. He concluded that people on the average spent 70 per cent of their working hours on communications of one form or another; he further broke down these totals to 9 per cent in writing, 16 per cent in reading, 30 per cent in talking, and 45 per cent in listening. Hospital dietitians, for example, spend 34 per cent of their job time listening.[4] Industry has spent much time and money for research to improve listening. Business executives estimate that they spend from 50 per cent to 80 per cent of their time in the listening role.

A good supervisor, because she knows listening has a therapeutic value, gives her co-worker time to talk out his problems, and release from tension occurs when he unburdens himself. She lets him "get it off his chest" as she listens with empathy rather than sympathy. She recognizes that every person has a right to his opinion and she accepts him at his face value, with all his faults and prejudices. She puts herself in the other person's shoes knowing she, too, has human weaknesses and failings. She knows she must put aside what she is doing to listen to an employee and indicate to him her desire to help and understand him. How often do we realize many of our problems and difficulties could have been solved if we only took the time to listen! Without question, listening enriches one's personal life. Listening can be improved through proper guidance, practice, and application of greater concentration and self control.

The student therapist knows her supervisor is one who will take the time to listen to her many problems, because she hasn't forgotten that she was once a student. Students today, as well as yesterday, enter our schools with a noble goal in mind, namely to help people. A good supervisor realizes that these young, eager, yet carefree people need understanding, security, and a feeling of belonging to the hospital family. Students must be guided slowly along the path toward maturity. Supervisors have an obligation to channel the desires and enthusiasm toward that goal and not make the mistake of stifling it by plunging students headlong into an environment they are not ready to meet. She must be willing to accept their immaturity with patience and understanding if she is to help them gain the confidence needed in their clinical experience. These young people look to the supervisor to be their strength, guide, and support. Students must be oriented slowly into the busy, bustling hospital life. As the plans for their future begin to unfold before them, they begin to develop into mature, intelligent young people. They see, perhaps for the first time, the patient as a unique individual with common needs which arise from the fact that he is a human being, composed of a body and soul, and having special needs arising from his own peculiar personality and problems.

Recently, I read an article, "Selecting and Using Methods of Teaching in the Clinical Fields," by Martina App Wagner,[5] in which she makes this statement on motivation of students:

> In discussing motivation of students it seemed that the instructor's proper use of a variety of methods of teaching would foster the attention and interest of students. The factor of readiness was considered in relation to learning experiences. The student needs security; and dissatisfaction and sometimes trauma may result from repeated exposures to situations for which the student is not prepared. Care in making assignments, informing the student regarding her progress, the proper use of well constructed tests signifying to the student that the instructor is truly in-

terested in her, were deemed worthy and worthwhile devices to motivate students to better performance. Other strong factors in influencing motivation were sound orientation to services and desired outcomes, the use of praise and reward as recognition of achievement, and provision for the encouragement of a healthy social environment.

Students will be motivated in great measure by the guidance we give them. For instance, each morning we hold a 10 to 15 minute conference which begins with a prayer to ask the help of the Divine Physician in our work.[6] The staff discusses the new patients to be treated and any other problem in the present case load. If the problems cannot be solved in our group discussions, they are presented to the physiatrist at the morning report who then takes up the problem with the therapist concerned. This discussion enables the staff to know the progress of individual patients, while the supervisor learns a great deal about her staff through the manner in which the patient's progress is reported and the attitudes displayed by the staff. These discussions are excellent means to help students learn about a patient's progress, how to present a problem concerning a patient's condition, and what means are used to remedy it.

The supervisor can use this time to draw out the timid student by discussing his patient. The student should acquire the ability to transmit clear, concise and accurate information. This enables the student to gain confidence in himself, while the supervisor evaluates his understanding of the facts of the case, his poise, his diction, and his ability to speak before a group.

It is an obligation of the supervisor to impress upon the student the value of the clinical training period. The student should know that it is a privilege and an opportunity for him to be able to apply the theory acquired during the school years under the direction and guidance of competent teachers. The supervisor is very much aware that the clinical training period is a continuation of the learning process. She knows that the didactic program and the clinical program must function in close relationship to give the best service to the patient, the hospital, and the community. She strives to give the student every opportunity to increase in growth and knowledge. She not only expects, but makes certain that the students attend conferences, see films, and make use of the library and reading material at their disposal.

The good supervisor alerts her staff members to the responsibility they have as teachers to the students and that teaching is the instruction, the initiation, the stimulation, the direction, and guidance of learning activities. This takes much time and effort but as it increases the students' knowledge, it also increases the staff members' knowledge, initiative, and ability which is so essential to the department.

Delegation of authority is necessary to relieve supervisors of many pressing duties. A supervisor should be willing to delegate authority to her staff members. Willing acceptance of additional responsibility and doing the job well increases the individual's self reliance and makes him a valuable member of the group.

I think these 10 guideposts sum up fairly well what one likes to find in the person he admires and respects:[7]

1. Sincerity of your smile
2. Warmth of your handclasp
3. Neatness of your appearance at work
4. Tolerance you have for others' opinions
5. Gentleness in your voice
6. Readiness you display to listen
7. Importance you put on keeping your promise
8. Kindliness in your temperament
9. Eagerness to improve yourself
10. Interest you display in the welfare of others

These guideposts can be helpful for both the supervisor and the student in their relationship with each other. Students are quick to observe the attitudes of the supervisor and they soon reflect her viewpoints. Her enthusiasm, earnestness, and interest becomes a part of them.

A supervisor's ability to cooperate with the various departments and the numerous personnel she meets daily marks her as a kind, sympathetic, and tactful person. To be successful in her work, she must gain the confidence of everyone with whom she comes in contact, both those above her and those whose work she directs. Confidence develops from reliability and sincerity.

Loyalty is another important personal characteristic for one in a supervisory position. The supervisor is loyal to her school and to the hospital where she is employed. She is expected to show loyalty to her students as well as to her administrator. A supervisor knows, where people are working together, there is bound to be friction, irritation, and disagreements and that she must be patient and tactful when she corrects them. She is conscious of the fact that she, too, needs guidance just as others with whom she works and she welcomes the help offered to her. She does not allow petty jealousy, sarcasm, uncharitableness, backbiting, or grudge-bearing to mar her good work or the good work of others. She makes it clear by her actions that these faults and failings have no place in her life or

profession. She must strive to develop her own fund of knowledge by an active participation in meetings, conferences, and workshops. As she grows in wisdom and knowledge, it will be manifested by the attitude of the staff toward its work, and by the attitude of students toward their didactic and clinical program.

In summary, a supervisor is a dedicated person, one called to teach, counsel, guide and direct those entrusted to her care. This, then, is your life, a life full of labor and love for God and your neighbor.

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7. Benders, James Frederick: National Institute of Human Relations.

New Appointment

Dr. Minnie L. Lynn has recently been appointed Director of the Bouvé-Boston School, affiliated with Tufts University in Medford, Massachusetts. She will assume her new duties on May 1, 1960. Constance K. Greene continues in her same position of Chairman of the Department and Professor of Physical Therapy; as does Jean Gertrude Brown who is Chairman of the Department of Physical Education and Associate Professor.

CHA Continuing Education Program

The Catholic Hospital Association will conduct a program of continuing education for physical therapists to be held March 7-11, 1960, at the Pick-Melbourne Hotel, St. Louis. The sessions will present information on the development and administration of physical therapy services, particularly in small general hospitals, newer technics for the application of physical agents, and the psychology of the physically handicapped. Attendance will be limited; the registration fee is $45.00. For further information write: John T. James, Director, Continuing Education, Catholic Hospital Association, 1438 South Grand Blvd., St. Louis, Mo.

The Need For Continuing Education *

Arthur L. Watkins, M.D.

In these days of expansion in medical rehabilitation there are ever increasing numbers of diseased and injured people, including those with degenerative conditions of old age, who can benefit from rehabilitation services. The economic aspects of such therapy, and in particular physical therapy, have to be considered. The physical therapist in carrying out her professional duties has an opportunity to ease some of these economic pressures by determining that the therapy she or he is giving is the one which is more effective.

Although it is the physician's or surgeon's duty to prescribe treatments to be given by the therapist, the treatment details are often, to a large extent, left to the hands of the individual therapist. Whenever a treatment is given, the therapist should judge the treatment and evaluate its benefits. For example, very often the success of a treatment is as largely dependent on the skill as the method of treatment. It is accordingly suggested that every therapist examine each treatment given to determine whether the most valuable contribution for the good of the patient has been made and, if not, in what way this can be improved. This implies that it is the never ending duty of a professional person, such as a physical therapist, to constantly seek methods to improve her education and skill in carrying out her professional duties. Direct and continuing contact with the referring physician for discussion and progress reports should be helpful. Routine physical therapy should be discarded as ineffective, expensive, and not worthy of a professionally trained individual.

Assistant Clinical Professor of Medicine, Harvard Medical School; Chief of Physical Medicine, Massachusetts General Hospital; Medical Director, Bay State Medical Rehabilitation Clinic.

* Reprinted from the Massachusetts Chapter Newsletter, Vol. 1, No. 2, November, 1959.

Schools Offering Courses in Physical Therapy

APPROVED BY THE COUNCIL ON MEDICAL EDUCATION AND HOSPITALS
OF THE AMERICAN MEDICAL ASSOCIATION

Schools offering the four year program leading to a baccalaureate degree accept high school graduates and transfer students. Schools offering the 12 to 16 months' program leading to a certificate accept students who have completed all or most of their undergraduate work providing they meet certain course requirements. Recipients of a degree and/or certificate have equal professional status. For specific information regarding each school's entrance requirements, curriculum, tuition and other fees, write to the physical therapy director indicated below. All students should investigate course requirements *early*.

	Degree	*Certificate*
CALIFORNIA		
Mary J. Dodge School of Physical Therapy Childrens Hospital Society 4614 Sunset Boulevard Los Angeles 27	‡	†
Ronald A. Hershey School of Physical Therapy College of Medical Evangelists Loma Linda	†	†
Lucille Daniels Division of Physical Therapy School of Medicine Stanford University Stanford (Palo Alto)	†	†
Margery L. Wagner Curriculum in Physical Therapy University of California The Medical Center San Francisco 22	†	†
Margaret S. Rood Department of Physical Therapy University of Southern California Los Angeles 7	†	†
COLORADO		
Dorothy Hoag Curriculum in Physical Therapy University of Colorado Medical School Denver 20	†	†
CONNECTICUT		
Frances M. Tappan School of Physical Therapy U 101 University of Connecticut Storrs	†	
ILLINOIS		
Elizabeth C. Wood Course in Physical Therapy Northwestern University Medical School 303 East Chicago Avenue Chicago 11	†	†
INDIANA		
Frances C. Ekstam Physical Therapy Program School of Medicine Indiana University Medical Center Indianapolis 7	†	
IOWA		
Olive C. Farr Physical Therapy State University of Iowa Hospitals Iowa City		†
KANSAS		
Ruth G. Monteith Section of Physical Therapy Education University of Kansas Medical Center Kansas City 12	†	†
MARYLAND		
Gladys E. Wadsworth, Ph.D. Department of Physical Therapy School of Medicine University of Maryland Baltimore 1	†	
MASSACHUSETTS		
Adelaide L. McGarrett Physical Therapy Department Boston University Sargent College University Road Boston 15	†	†
Constance K. Greene Department of Physical Therapy *Bouvé-Boston School, Tufts University Medford 55	†	
Shirley M. Cogland *Program in Physical Therapy Simmons College The Fenway Boston 15	†	†
MICHIGAN		
Virginia Wilson Curriculum in Physical Therapy The University of Michigan University Hospital Ann Arbor	†	†
MINNESOTA		
Dale V. Shaffer School of Physical Therapy Mayo Clinic Rochester		†
Wilbur L. Moen Course in Physical Therapy University of Minnesota 860 Mayo Memorial Building Minneapolis 14	†	

* Accepts women students only.
‡ Baccalaureate degree available from an affiliating college or university.

	Degree	Certificate
MISSOURI		
Sr. M. Imelda, S.S.M. Department of Physical Therapy St. Louis University 1325 South Grand Boulevard St. Louis 4	†	
Beatrice F. Schulz Department of Physical Therapy Washington University School of Medicine 660 So. Kingshighway St. Louis 10	†	
NEW YORK		
Dorothy L. McLaughlin Russell Sage College-Albany Medical College Division of Physical Therapy Albany 8	†	†
Mary E. Callahan Courses for Physical Therapists Columbia University College of Physicians & Surgeons 630 West 168th Street New York 32	†	†
Elizabeth C. Addoms Physical Therapy Curriculum School of Education, New York University Washington Square East New York 3	†	†
Mildred F. Heap Program in Physical Therapy University of Buffalo 3435 Main Street Buffalo 14	†	†
NORTH CAROLINA		
Helen Kaiser Division of Physical Therapy Box 3403, Duke University Medical Center Durham		†
Margaret L. Moore Section of Physical Therapy School of Medicine University of North Carolina Chapel Hill	†	
OHIO		
Robert D. Kruse, D.P.E. Course in Physical Therapy Frank E. Bunts Educational Institute 2020 East 93rd Street Cleveland 6	‡	†
Gladys G. Woods Curriculum of Physical Therapy Ohio State University University Hospital Columbus	†	†
OKLAHOMA		
Thelma Pedersen School of Physical Therapy University of Oklahoma, Medical Center Oklahoma City 4	†	†
PENNSYLVANIA		
Dorothy E. Baethke Division of Physical Therapy University of Pennsylvania 3901 Pine Street Philadelphia 4	†	†
Kathryn Kelley Division of Physical Therapy D. T. Watson School of Physiatrics Leetsdale	‡	†
PUERTO RICO		
(All classes given in Spanish) Lutgarda V. Piñeiro School of Physical & Occupational Therapy Candelaria & Mandry Streets Stop 22, Santurce	†	†
TEXAS		
Doris E. Porter Grady Vaughn School of Physical Therapy Baylor University Medical Center Dallas 10	†	†
Cecelia J. Lee School of Physical Therapy Hermann Hospital Houston 25	‡	†
Ruby Decker School of Physical Therapy The University of Texas Medical Branch Galveston	†	†
VIRGINIA		
Susanne Hirt School of Physical Therapy Medical College of Virginia Richmond 19	†	
WISCONSIN		
Beth J. Phillips Curriculum in Physical Therapy Marquette University School of Medicine 561 North 15th Street Milwaukee 3	†	
Margaret Kohli Course in Physical Therapy University of Wisconsin Madison 6	†	
U. S. ARMY MEDICAL SERVICE		
*Physical Therapy Course Army Medical Service School Brooke Army Medical Center Fort Sam Houston, Texas Write to: The Surgeon General Department of the Army Washington 25, D. C. Att.: Personnel Division		†

* Accepts women students only.

‡ Baccalaureate degree available from an affiliating college or university.

Please direct all inquiries regarding tuition, entrance requirements and other specific information to the school and *not* to the American Physical Therapy Association.

Abstracts

Aerial Dissemination of Pulmonary Tuberculosis

R. L. Riley, C. C. Mills, W. Nyka, N. Weinstock, P. B. Storey, L. U. Sultan, M. C. Riley, and W. F. Wells (Veterans Administration Hospital, Baltimore, Maryland), AM. J. HYG., 70:185-196, September 1959

This is the third paper in a series of three dealing with quantitative studies of the infectiousness of the air in a tuberculosis ward.

These studies were carried out in an experimental unit consisting of a tuberculosis ward of six single rooms, a carefully controlled and calibrated closed circuit ventilating system, and a large animal exposure chamber located in the exhaust duct of this system.

Between November 1956 and November 1958, 71 guinea pigs breathing air from the pilot ward became infected with tuberculosis. The diagnosis of tuberculosis was accepted only after pathological confirmation.

The exposure chambers were kept scrupulously hygienic. All of the animals were placed in quarantine when first obtained and tuberculin tested. None of the animals used were tuberculin positive.

At autopsy single primary pulmonary tubercles were usually found in the lungs of infected guinea pigs. The cultural characteristics and drug susceptibility of the organisms taken from the guinea pig lungs matched those of the patients occupying the ward at the time.

On 35 occasions, the aerial infectivity of artificially atomized sputum from patients occupying the pilot ward was studied. The result of this experiment showed that (a) the number of tubercles in the guinea pig lung depended on the number of infectious droplets inhaled, and (b) in general the distribution of tubercles throughout the lungs was random.

The nature of the pulmonary lesions seen in the guinea pigs seem to prove that the tuberculous infection was transmitted aerially, since other means of pulmonary infection are unlikely to produce a single pulmonary tubercle. Because the majority of the animals remained uninfected, it seems unlikely that the infected animals received more than one infectious dose. Under the conditions of this experiment the characteristic lesion resulting from aerial infection was the single tubercle, attributable to a single air-borne particle.

The number of viable air-borne tubercle bacilli are not very numerous, and perhaps for short periods of time breathing the air from a room of a tuberculous patient would not be dangerous. However the product of aerial infectivity times long duration of exposure appears to be high enough to account for the spread of pulmonary tuberculosis in human beings. This evidence suggests that pulmonary tuberculosis is a classic example of air-borne contagion.

The Late Effects of Spinal Poliomyelitis

C. Hollenberg, M. H. L. Desmarais, L. Frihayen and A. Dale (Department of Surgery, University of Manitoba, Winnipeg, Manitoba), CANAD. M. Ass. J., 81:343-347, Sept. 1, 1959

There are only a few reports in the medical literature pertinent to prognosis with respect to functional recovery and to the extent of the rehabilitation problem in poliomyelitis.

Five hundred and sixty-eight patients admitted in the early stage of their poliomyelitis to Winnipeg Municipal Hospitals in the Manitoba epidemic of 1952-53 were studied. All of the patients were followed up for at least two years. Records were kept of: (1) the extent and distribution of paralysis, (2) the presence and type of deformities, (3) splints, braces, wheel chairs, corsets, etc., (4) the number and types of operations performed, (5) functional status, and (6) those who had to change their occupations.

Of the 568 studied 337 were under 15 years of age and 231 were adults. One hundred and seventy-five of the children and 65 of the adults had some deformity. In the children's group scoliosis was the most frequent deformity noted. Only 11 adults developed scoliosis, but none was severe enough to require surgery or external support.

Two hundred and ten patients were fitted with leg braces, 52 patients were fitted for upper extremity appliances, 147 wheel chairs were provided, and 109 corsets were fitted—mostly for the support of paralyzed abdominal muscles.

One hundred and forty operations were performed on 92 patients. Twenty of these were for scoliosis and 87 for various foot problems.

Of the 568 patients 42 patients with severe involvement required full time care, 477 were independent, and 49 needed some assistance in carrying out some of the activities of daily living.

Maximum paralysis was obvious in most cases during the initial hospital stay. A few patients discharged as nonparalytic after a short hospital stay were found to have some degree of paralysis when examined four weeks after discharge. Although 60 per cent of the patients studied were under 16 years of age, the adults were more severely involved; 78 per cent of the adults were "severe" compared with 24 per cent in the younger age group. Approximately 75 per cent of deformities occurred in children. Scoliosis was one of the most serious deformities from polio in children.

The cost of constant after care in poliomyelitis is great. Approximately 80 per cent of the patients in this study made an excellent functional recovery, and this justifies the investment.

Orthokinetics: A New Receptor Facilitation Method

Manfred R. M. Blashy and Renate L. Fuchs (Physical Medicine and Rehabilitation Service, VA Center, Temple, Texas), AM. J. OCCUP. THER., 13:226-234, September-October 1959

Orthokinetics represents another type of rehabilitation therapy which utilizes the exteroceptors of the skin and indirectly the proprioceptors of the muscles and tendons. The method was originally developed by the late Julius Fuchs, an orthopedic surgeon of New York. His monograph on the subject was first published in 1927. He had become dissatisfied with the currently used braces, splints, and casts and wanted to create dynamic ones which would avoid or at least reduce the damage of immobilization. He therefore used a "Lederstreifen," a bandlike cuff or segment made of leather which was composed of an inelastic part and an elastic part. Several of these were combined to form the "orthokinetic tube." The part to be treated was encased in this inelastic-elastic tubular device in a specific manner. Where he wanted muscular activity, he placed the elastic part, and where he wanted limitation of activity or supportive action, he placed the inelastic part. He also developed an intricate lacing technic with which he apparently controlled direction and tension within the tube.

Modifications of this original "Lederstreifen" have been made by

the present proponents of this method. Rubber-reinforced elastic bandage is now used. One part is made inelastic by sewing layers tightly together. Several of these segments may be sewn together forming the orthokinetic tube. The absolutely essential feature of these devices is the combination of elastic and inelastic elements. The patient exercises with the segment(s) in place as he performs his work with apparatus (shoulder wheel, stationary bicycle, wrist exerciser) while in the hospital, or with the therapist.

Three case histories are presented with illustrations of the specific method used. Two further case histories are presented with photographic evidence of immediate success. Observations were also made on "normokinetic" volunteers. From the combined observations, the effects of orthokinetics can be summarized as follows:

1. Facilitation and impedance respectively of antagonistic muscle groups in a reciprocal pattern.
2. Relief of pain, sometimes rapid.
3. Improvement of coordination.
4. Decrease of spasticity.
5. Increase of muscle power.
6. Increase of range of motion.
7. Muscle reeducation, almost completely automatic, requiring only supervision of the accurate placement and wearing of the segments.
8. Restoration of motor patterns by exercise with orthokinetic segments in place.
9. Retaining of a thus acquired or re-acquired motor function, even after removal of the orthokinetic devices.
10. Stabilization of joints.

Case One describes the treatment of a 59 year old white male who had a right hemiplegia with some aphasia. He showed moderately severe spasticity in the biceps and in both the flexors and extensors of the forearm with severe incoordination. He was totally unable to pick up even a large object. Orthokinetic treatment was started three years after the stroke. Two orthokinetic segments were put on the patient's forearm with the inactive field over the brachioradialis-extensor group. Another segment was placed over the upper arm with the inactive field over the biceps. This was planned with the idea of impeding flexion at the elbow and facilitating flexion of the wrist and fingers. The patient was immediately capable, with a still somewhat jerky but fairly coordinated motion, to pick up not only a stapler, but also a tongue depressor and, a few minutes later, even an object as small as a paper clip.

Mention is made of a forthcoming paper by one of the authors, attempting to explain why orthokinetics produces the effects described. Brief mention is made of the existence of "motor areas" in the skin as experimentally proven by Hagbarth on spinal cats. It is felt that orthokinetic segments stimulate the "skin motor areas" and through them the motor neurons, thus producing the effects observed in the clinic.

A Clinical and Experimental Study of the Effects of Exercise on Motor Weakness in Neurological Disease

J. A. R. Lenman (Neurological Unit, Northern General Hospital, Edinburgh), J. NEUR., LOND., 22:182-194, August 1959

Muscular weakness is a common neurological symptom. Often it is necessary to decide whether the affected muscles should be rested or given exercise. If exercise is indicated it is important to know the most effective method of carrying it out. If therapy is to be on a sound basis, the physiological changes which exercise produces in nerve and muscle should be understood. As little is known about them, the authors set out to establish a few facts on an empirical basis. They directed their attention to three questions; namely, the effect on weak muscles of a system of exercise which has been shown to strengthen healthy muscle, the effect of deliberately produced fatigue, and the effect of confinement to bed without exercise.

The biceps and triceps of the upper extremity were selected for study. The measurements of muscle strength were made with a dynamometer designed to register the isometric tension of the biceps and triceps. This apparatus was also used to carry out training sessions of isometric exercise. A training session consisted of 30 maximum isometric contractions carried out at 30 second or 1 minute intervals. A small group of patients was given weight lifting exercise designed to investigate the effects of fatigue.

The study included 6 normal subjects and 29 patients grouped into one of the following categories—disorders of muscle, disease of anterior horn cells and pyramidal tracts, demyelinating disease, and miscellaneous cases (cervical root lesion, cervical spondylosis, poliomyelitis, brachial neuritis and cerebral thrombosis).

The results are given in detail for each subject studied and then summarized as follows:

Isometric exercises are an effective means of improving strength of healthy persons. They need not cause fatigue to be effective.

It is possible to increase the strength of a patient with a muscular dystrophy, but slowly, and progress of the disease may undo any benefit achieved.

Weakness resulting from degenerative disease of the nervous system is not affected by exercise, unless the loss of strength is the result of disuse.

When a paralyzed muscle is recovering either through specific treatment, or spontaneously, there is evidence that active exercise increases the rate of recovery.

Patients with motor weakness due either to primary muscular disease or to disease of the central nervous system may deteriorate with rest in bed. The deterioration is caused in part by disuse, in part by an increase in stiffness and may be corrected by active exercise.

No adverse effects have been shown to result from fatigue in primary muscular or neurogenic paralysis.

Fractures of the Elbow Requiring Open Reduction

Frank Owen McGehee (Houston, Texas), SOUTH. M. J., 52:1234-1240, October 1959

In isolated fractures of the humeral condyles, the olecranon, coronoid processes of the ulna or tubercle of the radius, marked displacement and rotation may occur because of the powerful muscle pull. Injuries to the collateral ligaments may cause secondary fractures of the involved epicondyle, whereas injuries to the annular ligament usually result in displacement of the head of the radius. It is the purpose of this paper to present cases illustrating indications for open reduction of fractures of the elbow.

In both the child and adult groups, operations are divided into three groups: those of necessity, choice, and those to be avoided. Those of necessity are open reductions of compound fractures and fractures complicated by neurovascular injuries. Operations of choice are those elective procedures which do not have to be done immediately and include

fractures of the head of the radius, fractures of the radial tubercle, fractures of one or both of the condyles of the humerus, olecranon fractures, and reconstructive procedures. Those to be avoided are open reductions of extensively comminuted fractures in which traction is obviously the best treatment in order to minimize contracture and subsequent limitation of motion.

The author presents numerous case reports and X-ray reproductions to illustrate the operations of choice and those to be avoided. Two case reports deal with a complete replacement prosthesis for the elbow used primarily in healed "side-swipe" fractures. Indications for this procedure are (1) painful and degenerative traumatic arthritis, (2) bone tumors involving any of the bony structure of the elbow, and (3) advanced rheumatoid arthritis with fair musculature. Functional range of motion was obtained in both, and one patient was able to do heavy work.

Although the elbow is a nonweight-bearing joint whose primary function is motion and not stability, certain principles of treatment are unique to this joint. These fractures are treated differently in adults and children because of the active growth centers in the latter.

Save That Hand

Carl E. Nemethi (Los Angeles, Calif.), WEST. J. SURG., 67:272:277, September-October 1959

There is no man-made mechanism that parallels man's hand. The hand is an entity, "a one-unit mechanism of beauty and coordinated movement." The goal in repairing this highly skilled mechanism is to fashion a cosmetic, sensory, and useful hand; one which is accepted and presentable.

The author selects basic concepts of the anatomy and physiology of the traumatized hand—concepts found to be of value in his own experience. He stresses the importance of saving all pieces of the injured hand, even those parts scattered on the factory floor. He suggests the only indication for amputation is the job already done by the buzz saw or punch press.

The various specialized tissues of the hand are briefly discussed in the light of reconstruction possibilities. The phalanges, carpals and metacarpals each present their own individual problems so far as the bony tissue is concerned. The vascular system must be preserved at all costs as tissues cannot survive without nourishment. Since inadequacy of the venous drainage system is the common cause of ischemia the author points out the possibilities of repairing this system and making do with what is left. In the same way the abundant supply of peripheral nerves in the hand make anastomosing with other intact nerves possible. The fascias, the tendons, and the maintenance of muscle function are all considered in the rebuilding of the traumatized hand.

Several cases are described and illustrations are used to clarify the discussion.

Lateral Ankle Ligament Reconstruction

Louis J. Levy (918 Eighth Ave., Ft. Worth, Texas), TEXAS M. J., 55:824-827, October 1959

The author states that the ankle is the most commonly injured major joint in athletics. The type of injury most pertinent in a discussion of injuries to the ankle ligaments involves inversion or adduction of the ankle.

In simple strains, the injury apparently is a matter of stretching or partial tearing of portions of the lateral ligament giving rise to lateral swelling and tenderness, muscle spasm and splinting, pain on motion, but no ankle instability. Suggested treatment is supportive taping to prevent adduction, followed by physical therapy measures to absorb inflammatory exudate and to restore normal ankle mobility, muscle length, tone and strength. Three weeks are required for basic ligament healing and 5-6 weeks before maximum recovery of ligament strength. In the more severe injuries requiring plaster immobilization, followed by the outlined physical therapy program, it will take even longer before complete restoration of joint motion, muscle strength and control are attained.

If the injury is so severe or in cases where conservative management has not resulted in a stable ankle the Watson-Jones type of lateral ankle ligament reconstruction is recommended. The distal tendon of peroneus brevis is transplanted so as to prevent inversion and to block anteroposterior laxity.

The author emphasizes that the best treatment for any athletic injury is to prevent its occurrence.

Gout and Gouty Arthritis

J. H. Talbott and A. Ricketts (Buffalo General Hospital, Buffalo, New York), AM. J. NURS., 59:1405-1408, October 1959

Gout and gouty arthritis are not oddities; the disease has a sufficiently high incidence to justify consideration in any discussion of joint disorders.

Gout is a familial malady associated with an increased formation of uric acid by the body. Approximately 10 per cent of the patients suffering from gout develop the disturbance of uric acid metabolism as a result of a blood dyscrasia. Therefore, if a patient with a blood disorder complains of acute joint distress, the concentration of uric acid in the blood should be determined and the possibility of gout considered.

Once gout is suspected, the patient should be immediately started on a prophylactic regimen. The prophylactic regimen involves the combined use of a drug which increases the excretion of uric acid from the body and an antiarthritic drug useful in the prevention of recurring articular distress. Probenecid (Benemid) is the uricosuric drug; colchicine is the antiarthritic drug. The other measures recommended in the prophylactic regimen embody sensible rules of living and little else. However, the surgical removal of large tophi may be necessary for cosmetic reasons or because of interference with motion.

In all types of severe joint disorders, the prognosis is better in gout than any of the others. Gouty arthritis need not be a progressively incapacitating disease if proper treatment is followed.

Changing Concepts in the Management of Neuromuscular Dysfunction

Harriet E. Gillette (Gainesville, Florida), SOUTH. M. J., 52:1227-1229, October 1959

A brief review of the better known systems of treatment of cerebral palsy is given. It includes the thoughts of Little in 1853; observations of Bronson Crothers; the technics of Phelps, Deaver, Pohl, Schwartz, Fay, Kabat, Rood, and the Bobaths. The author doubts that reliable statistics will ever be gathered regarding the relative efficiency of different methods of treatment. She does feel, however, that methods of quantitating

the various components of muscle action are developing and that the use of these may eventually lead to an evaluation of the various phases of the above procedures. It would then be possible to adopt the worthwhile features of all systems outlined and to fit them into a framework of treatment of the whole person. A plea is also made for resurrection of the principle of treating manifestations of the disorder, rather than the theory of their pathogenesis.

Ultrasonic Therapy

Fritz Friedland (Veterans Administration Hospital, Boston), AM. J. NURS., 59:1272-1275, September 1959

The present status of the use of ultrasound in medicine has been discussed with consideration to the physics of acoustic energy, the basic physiological effects, and the clinical application.

Ultrasound in nondestructive doses is superior to other forms of thermal therapy in a number of clinical conditions.

Ultrasound as a neurosurgical tool and as a diagnostic device appears to be promising and is expected to be developed further for more practical usefulness and wider acceptance.

Abstracters for February

We are indebted to the following Association members for the carefully prepared abstracts that appear in this issue:

Ethel Coeling Shirley Clemenson
Estil Latimer Jean Cuthbertson
Geraldine Midgely
Miriam Partridge

Book Reviews . . . . .

Modern Trends in Diseases of the Vertebral Column. *Edited by Reginald Nassim, B.M., F.R.C.P., Physician to St. George's Hospital, Physician to the Royal National Orthopaedic Hospital, London. And H. Jackson Burrows, M.D., F.R.C.S., F.R.A.C.S., Orthopaedic Surgeon to St. Bartholomew's Hospital and to the Royal National Orthopaedic Hospital, London; Dean, Institute of Orthopaedics, British Postgraduate Medical Federation (University of London); Consulting Orthopaedic Surgeon to the Royal Navy. Cloth; price $15.00. Pp. 292; illus. Paul B. Hoeber, Inc., New York, 1959.*

Because severe backache may only be imagined, and a slight sciatic twinge may mask a serious complication, studies of conditions of the back are of interest. This reference work, as its title implies, contains a summary of current thinking on diseases as they affect the vertebral column. Its usefulness lies in the attempt to concentrate in one volume information otherwise found in widely scattered sources. It seeks to demonstrate the interplay of symptoms referable to the spine which may be early indications of a wide variety of conditions, ". . . neoplastic, endocrinological or inflammatory . . ." The editors, both physicians, have drawn their material from excellent sources. Written by leaders or specialists in the particular field under discussion, the majority British, Fellows in the Royal College of Surgeons, the content reflects both the study and experience of these men.

Opening with a treatise, in this case by an anatomist, on the anatomy and development of the vertebral column, a chapter follows on developmental defects, Congenital Anomalies, and the next: Scoliosis. Both have a number of X-ray and photographic studies, especially of the more extreme cases. Throughout the remainder of the text are a scattering of X-ray reproductions and microscopic studies of pathological specimens.

Other topics dealt with more briefly are in order: degenerative diseases, including considerable material on the intervertebral disk, and related osteophytosis; osteoporosis; tuberculous diseases; and nontuberculous infections. Ankylosing spondylosis is discussed as a separate entity, differentiated from rheumatoid arthritis in both progression of the disease process, as well as in manner of treatment. Another section is devoted to cervical spondylosis: the prolapsed disk here causing more neurological consequence than in either lumbar or thoracic region. Indications for surgical intervention to relieve pain and crippling are given.

The chapter on tumors of the vertebral column is limited to those of bony tissue and the special problems posed by their presence. A discussion on radiology emphasizes the difficulty of procuring good plates of the spine as well as interpretation of them. Use of radiation in treatment of certain diseases is analyzed, and comments made on radiation hazards. A straightforward outline on "Management of Spinal Cord Injuries" is refreshing in contrast to some of the more ponderous chapters preceding it. And by the nature of the subject matter, the chapters on "Low Back Pain" and "Functional Backache" are both more informal in manner of presentation. The closing report, "An Assessment of Spinal Biopsy," underscores this limited but important place in diagnosis and treatment.

Adequate bibliographies relating to the subject follow each chapter. In a work of this sort, repetition is inevitable, however contradictions are at a minimum. The editors are to be commended for presenting a group of reports so uniformly comprehensive and stimulating.

Therapeutic Electricity and Ultraviolet Radiation. *Edited by Sidney Licht, M.D., Assistant Clinical Professor of Physical Medicine, Yale University School of Medicine, New Haven, Connecticut. Ten Contributors. Vol. 4. Cloth; price $10.00. Pp. 374; illus. Elizabeth Licht, New Haven, 1959.*

This, the fourth volume of the Physical Medicine Library edited by Dr. Sidney Licht, contains two sections which are vastly different. The first 169 pages, consisting of five chapters, deals with therapeutic electricity, basically electrical stimulation, ion transfer, and related topics. The second section of four chapters from pages 179 through 343 deals with the field of ultraviolet radiation.

The quality of the chapters and the presentations in this fourth volume appear to be consistently superior to previous texts in this library series. In the section on therapeutic electricity there are the usual chapters on history and instrumentation in this area. The chapter on instrumentation by Stuart Reiner and the one on Clinical Electrical Stimulation by G. Keith Stillwell are to the revewer particularly well done. In the section on ultraviolet radiation, which in length is practically equal to that on therapeutic electricity, the material is also well presented. It is good to have up-to-date information in a textbook available to physical therapists in the area of ultraviolet. Even though the field is perhaps less vital to the physical therapist, this presentation is a valuable addition to teaching and reference libraries.

As is true in previous volumes in

this series, the bibliographies are somewhat inconsistent; they vary in length and style and no publishers are listed. One important chapter on Instrumentation for Electrotherapy carries no bibliography at all. The illustrations are line drawings and no photographs are used in this text. Also, confusing perhaps, but academically stimulating is the inclusion of British authors and the appearance of British terminology. This may complicate the use of the text for beginning physical therapy students, but in the long run it perhaps enriches a curriculum to have a variety of views and a mixture of terminology presented.

Perhaps other volumes will be planned by Dr. Licht, and it is hoped that in time the books that have been presented may be consolidated and/or reorganized so that valuable material on instrumentation for electrotherapy, clinical stimulation, and electro and diagnostic or electrical testing materials may be published under one cover. They relate so closely in concept and clinical application that the future blending of elements of all four volumes might be considered. This is perhaps less true of the material in the volume on therapeutic exercise than it is on the volumes dealing with the field of electrotherapy. This fourth volume offers a distinct contribution to the field of electrotherapy, especially to the instructor in the field of therapeutic electricity with low tension currents. Unfortunately, the reviewer's copy of the volume was poorly assembled by the publisher and sections in the final chapters of the book were reversed and in some instances whole units of pages are missing. It is hoped that this is not true of other copies.

The volume will be of value to the physical therapy instructor and to physical therapy students, although it is the feeling of the reviewer that some material could be better organized among three volumes and in consolidating make a more logical presentation of materials in the field of electrotherapy.

Postural Drainage and Respiratory Control. *By E. Winifred Thacker, M.C.S.P., Superintendent Physiotherapist, Harefield Hospital, Ed. 2. Pp. 62; illus. Lloyd-Luke (Medical Books) Ltd., London, 1959.*

Miss Thacker has written this second edition "to illustrate the technic of postural drainage and gives the various positions in which the patient should be placed so that gravity can assist in the drainage of the bronchi" (Preface). Postural drainage often consists only of raising the foot of the bed or tipping the patient for a few minutes once or twice a day. This book describes how positioning in bed can be used over prolonged periods to obtain a more effective program of postural drainage. Careful consideration is given to the principles of under lung postural drainage and to the details of treatment.

This monograph is a concise treatise on the subject. The reader is reviewed briefly on the anatomy and physiology of the respiratory system before he is taken into the technic of postural drainage. The remainder of the book describes application of the technic to specific cases such as pre- and postoperative thoracic surgery, after abdominal surgery, and for the young and the aged. The technic of breathing combined with coughing and short-sharp diaphragmatic breathing is discussed also.

The booklet is well illustrated with both photographs and diagrams. The diagrams are most helpful in understanding the positioning of the patient for draining the affected lobe. A safer method of elevating the bed than by the use of stools as shown in the photograph can be arranged.

The second edition has been enlarged over the first edition, *Postural Drainage*, to include aids to coughing and "tipping in the home" as well as a discussion on the mechanism, function, and management of the thorax and breathing technics.

This book would be most helpful to anyone who has to treat cases concerned with postural drainage and respiratory control.

Physiology of Motion Demonstrated by Means of Electrical Stimulation and Clinical Observation and Applied to the Study of Paralysis and Deformities. *By Dr. G. B. Duchenne of Boulogne. Translated and edited by Emanuel B. Kaplan, M.D., Attending Orthopedic Surgeon, Hospital for Joint Diseases; Associate Professor of Clinical Anatomy, College of Physicians and Surgeons of Columbia University. Cloth; price $11.00. Pp. 612; illus. W. B. Saunders Co., Philadelphia, 1959.*

This outstanding book on physiology of motion in man has been in acute demand since the publication of the first English translation by Kaplan in 1949. With exception of the frontispiece, title page, and copyright page, the contents of this book is identical to the limited number of copies originally published by J. B. Lippincott.

In the "Translator's Introduction," Kaplan summarizes briefly the life and works of Guillaume Benjamin Amand Duchenne. His comment about *Physiology of Motion* is that it "contains an excellent record of the kinesiology of the entire muscular system, with very few exceptions, investigated by one observer whose genius, perseverance and originality permitted him a deeper insight into the action of muscles, than given to many of his predecessors and, perhaps, more modern investigators in this field."

The book is divided into four parts. The first two sections deal with individual action and use of muscles of the shoulder girdle, pelvis, upper and lower extremities. Part three is concerned with respiratory and craniovertebral column muscle actions. The final section is composed of the appendix and a supplement. The former discusses the influence of special senses on muscle function and coordination; the latter, facial muscles and expression.

Excerpts from this book have been quoted in a large percentage of current articles on kinesiology and related subjects. It is an extremely valuable book for physical therapists and students.

The Physiology and Pathology of the Cerebellum. *By Robert S. Dow, M.D., Ph.D., Associate Clinical Professor of Medicine (Neurology), University of Oregon Medical School; and Guiseppe Moruzzi, M.D., Professor and Head, Institute of Physiology, University of Pisa. Cloth; price $12.50. Pp. 675; illus. University of Minnesota Press, Minneapolis, 1958.*

This book is a monumental compilation of information on both the laboratory and clinical physiology of the cerebellum. The authors are well known for their extensive and important contributions to the knowledge of the functional organization of the cerebellum, and their approach is authoritative and complete.

The volume is divided into two major sections: Part I deals with physiology; Part II with clinical symptomatology and pathology. The first few chapters are a review of the literature on the effects of cerebellar ablation, the stimulation of the cerebellar cortex and nuclei, and the extensive electro-physiological experiments of recent years. There is an entire chapter devoted to the rela-

tions between the cerebellum and the spinal cord, the labyrinthine system, the cerebral cortex and sensory functions which should be of particular interest to physical therapists. The lucid discussions of the cerebellar influence on reflex activity and on cortically induced movement as well as the role of the cerebellum in control of movement via regulation of the gamma discharge will provide much insight for the understanding of the neurophysiological basis of current therapeutic procedures.

The functions of the cerebellum are succintly summarized in chapter 7. The classic theories of cerebellar function are discussed, but no new theories are presented covering such things as the relationships between the cerebellum, the brain stem, and the intrafusal system innervating the muscle spindles. The authors feel that "the time is not yet ripe for any attempt to formulate a new concept of cerebellar functions."

The clinical and neuropathological section of the book is of more general interest and covers a wide variety of neurological disorders involving the cerebellum. It is this part of the book which will be of greatest interest and help to the clinical physical therapist. Atrophic changes, hyperkinetic disorders, developmental anomalies, inflammatory and vascular diseases, tumors, and trauma are only some of the cerebellar conditions discussed.

Gait, postural and reflex disturbances receive considerable attention, and while the text is clear, more illustrations would have added clarity. Each chapter in Part II of the book is provided with a concise summary.

One of the greatest contributions of this volume is the 67 page close-type bibliography. This bibliography covers the international literature on the cerebellum as far back as the nineteenth century. References are listed both by author and by subject thereby making it one of the richest sources of information about the cerebellum.

The extensive documentation and literature citations in the text tend to make the reader lose the trend of the discussion at times, though this is not a serious criticism. There is a lack of anatomical description and information in the book, but this is explained by the fact that a volume on the comparative anatomy of the cerebellum is forthcoming by a colleague of the authors, Dr. Olof Larsell. The halftone illustrations frequently suffer from lack of sharpness and clarity.

This book is, without doubt, an outstanding contribution to medical literature. As such it would be a welcome addition to any departmental or personal library.

Speech and Brain Mechanisms. *By Wilder Penfield, M.D., Director of Montreal Neurological Institute; Chairman of the Department of Neurology and Neurosurgery of McGill University; holder of Order of Merit from British Crown and honorary degrees from seventeen universities. And Lamar Roberts, M.D., Chief of Neurosurgery at University of Florida Medical School; received M.Sc. and Ph.D. degrees from McGill University. Cloth; price $6.00. Pp. 285; illus. Princeton University Press, Princeton, New Jersey, 1959.*

In the preface to this monograph, the authors indicate the possible range of interest for which their book may prove useful. In doing so they mistakenly limit this field, for here is a text that will surely prove a most valuable tool to anyone with the slightest contact with neuroanatomy or neurophysiology. The scope of the text goes far beyond the boundaries of speech and its intricate mechanism and outlines clearly and concisely some fundamental concepts of the magnificent interrelationships of the human brain.

It is a book singularly well written, a fact that becomes more unusual when we consider that alternate chapters were done by different men. It is a happy coincidence for the reader that their individual styles are so nearly alike in interest, clarity, readability, and humor. The type face is well chosen and the text is arranged so as to make this book valuable for quick reference. Profuse illustrations of a size and detail of real usefulness add immeasurably to its worth.

The specific material contained represents a contribution of the most substantial data and reasonable hypotheses heretofore presented in one volume relating to internal brain mechanisms of speech, language, and their relationships with total brain function. While understandably confined to a major discussion of these specific functions, the book nevertheless adds considerably to a clear understanding of motor and sensory activities from both a neurophysiological and neuroanatomical standpoint. Of particular interest and value to the physical therapist is the practical section concerned with hemisphere dominance and handedness.

In the rapidly expanding world of knowledge relating to brain function, this book will stand as a classic example of exploration and conquest of new and exciting frontiers. In both the methods of research used and the objective compilation of data it represents a giant step forward into much that is still unknown. For anyone concerned with the care and intelligent treatment of patients with neurological syndromes, this text will be found to be an essential tool.

The reviews published here do not necessarily represent the opinions of the American Physical Therapy Association.

Book Reviewers for February

Eleanor J. Carlin, Associate Professor and Assistant Director of Physical Therapy, School of Allied Medical Professions, University of Pennsylvania, Philadelphia.

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III Therapeutic Exercise – '58 893 pp. 16.00
IV Therapeutic Electricity & Ultraviolet – '59 10.00
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WANTED: Qualified physical therapist for expanding outpatient Rehabilitation Center, treating both adults and children. Forty-hour, five-day week. Contact Clinton Owens, Rehabilitation Center, 316 Longwood Drive, S.W., Huntsville, Alabama.

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(continued on next page)

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Wanted PROGRESSIVE DIRECTOR and two qualified STAFF THERAPISTS to develop well equipped physical therapy department. Liberal personnel policies. Salary commensurate with experience. Contact Glenn C. Williams, Administrator, Mary Free Bed Guild Children's Hospital & Orthopedic Center, 920 Cherry St., Grand Rapids 6, Michigan.

PHYSICAL THERAPY CONSULTANT: Help develop a new state geriatrics consultation service to local health authorities and nursing home administrators. Assist in training institutes. Demonstrate physical therapy techniques. Need B.S. in physical therapy and four years' experience including two in specialized work with elderly, handicapped people. Start at $563. Wisconsin State Board of Health, State Office Bldg., Madison.

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STAFF PHYSICAL THERAPIST: for outpatient rehabilitation center treating both children and adults. Experience preferred but not essential. Starting salary, without experience, $4500. Forty hour, five-day week. Excellent personnel policies. Contact: Benedict R. Kraus, Chief P.T., Community Rehabilitation Clinic, 614 Dartmouth, S.W., Canton, Ohio.

WANTED: A trained physical therapist to organize a new department 300-bed hospital. Salary open depending on experience. Address: Hospital Administrator, St. Anthony Hospital, Terre Haute, Indiana.

PHYSICAL THERAPIST with at least one year experience to join staff of growing rehabilitation center. Patients include various types of handicaps. Excellent supervision and working situation, with Orthopedic Surgeons and other medical specialties. Beginning salary, $4,200 to $4,800 per annum. Contact Robert L. West, R.P.T., Easter Seal Therapy Center, Tallahassee, Florida.

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RPT's, male or female, for Physical Medicine and Rehab. Dept., Tampa General Hospital. $4400-$5500. Vacancy for Chief PT, $4944-$6327. Reply Rehabilitation Coordinator, Tampa 6, Florida.

Immediate opening for STAFF PHYSICAL THERAPIST, male or female registered New York State. New 250-bed general hospital with 24-bed rehabilitation department under direction of physiatrist. Salary open, 5-day week. Apply R. S. Hoffman, M.D., Memorial Hospital, No. Blvd., Albany, N. Y.

STAFF PHYSICAL THERAPISTS: needed for Iowa Methodist Hospital's newly opened 120-bed Younker Memorial Rehabilitation Center. Excellent chance for advancement. Competent supervision, professional staff and assistants. Both in- and outpatient work. Salary range $365-$420; 40-hour week, vacations, sick leave, holidays, insurance, other benefits. Inquire Personnel Department, Iowa Methodist Hospital, Des Moines, Iowa.

PHYSICAL THERAPIST: Orthopedic Clinic staffed by three orthopedic surgeons, in one of Chicago's beautiful North Shore suburbs. Interested only in top notch, experienced individual. Salary open. Ravinia Orthopedic Clinic, 695 Roger Williams Ave., Highland Park, Illinois.

QUALIFIED physical therapist for rehabilitation of children with orthopedic and neurological conditions. Wide variety of patients. Good starting salary with merit increases. Five-day week. Annual two week paid vacation. Eleven paid holidays. Sick leave. Excellent retirement plan. Continuous interdisciplinary teaching program. Write: Linda Wessel, Director of Physical Therapy, Illinois Children's Hospital-School, 2551 North Clark Street, Chicago 14, Illinois.

QUALIFIED PHYSICAL THERAPIST, female, April 1, 1960. Thirty-five hour week, paid vacation, sick leave and holidays. Salary open depending upon qualifications and experience. Physiatrist in charge of department. Reply to Arthur E. White, M.D., National Orthopaedic and Rehabilitation Hospital, 2455 Army-Navy Drive, Arlington, Va.

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Positions Available

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Physical Therapist — For NEW REHABILITATION CENTER connected with medical school and teaching hospital. Continuous medical supervision by physiatrist. Program includes physical, occupational, speech-hearing, psychological, vocational and social services. Will consider experienced therapist or recent graduate. Excellent starting salary. Liberal personnel policies and employee benefits including retirement and insurance plans and free University Tuition. Write Medical Director, Rehabilitation Center, University Hospital, 150 Marshall Street, Syracuse 10, New York.

CHIEF PHYSICAL THERAPIST—Male or Female—for rapidly expanding rehabilitation program in a multi-disability facility. Forty-hour week, two week vacation, sick leave, eleven holidays and retirement plan. Salary range $5,000-$5,900. Apply Personnel Director—Onondaga County Hospital, Syracuse, N. Y.

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REGISTERED PHYSICAL THERAPIST for well established department in 330-bed voluntary general hospital. Wide variety of cases. Above average starting salary. Air-conditioned department. Five-day work week. University city of 80,000. Apply Decatur and Macon County Hospital, Decatur, Illinois.

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OPENING in heart of recreational area for therapist (female). Excellent personnel policies, varied case load; new equipment. Supt., Elks Rehabilitation Center, Boise, Idaho.

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WANTED: ASSISTANT THERAPIST. Good opportunity for recent graduate, either male or female. Fully equipped department. Two weeks' vacation, holidays, sick leave. Good starting salary with regular increments. Write Raymond T. McHugh, Administrator, Memorial Hospital at Exeter, Exeter, California.

WANTED: Registered Physical Therapist for treating cerebral palsy, orthopedic and polio children from 2-12 years of age. Four week summer vacation, generous Christmas holiday, social security, 12 days sick leave, annual increments. Starting salary $3900-$4200 per annum depending on qualifications. Contact: Sister M. Canice, Supt., Rose-Mary Home for Crippled Children, 19350 Euclid Ave., Cleveland 17, Ohio. Phone: Iv. 1-4823.

QUALIFIED PHYSICAL THERAPIST (two) for outpatient cerebral palsy treatment center. Starting salary $4550 per year. Two months vacation, liberal sick leave benefits. Liberal personnel policy. Contact Robert Schlitt, Director, Peninsula Cerebral Palsy Training Center, 901-24th Street, Newport News, Virginia.

Positions Available

STAFF PHYSICAL THERAPIST: Well established department handling adult cases in a 604-bed general private nonprofit hospital. Department under orthopedic staff supervision. Salary open; 40-hour week; noon meal and laundry furnished; two weeks' paid vacation and sick leave; Blue Cross and Blue Shield plan available. Write Phillip B. Donley, Chief P.T., Akron City Hospital, Akron, Ohio.

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PHYSICAL THERAPIST—Male or female. Salary open. Good personnel policies. Hospital fully approved. Apply: Robert M. Murphy, Administrator, Floyd Hospital, Rome, Georgia.

PHYSICAL THERAPIST for outpatient Rehabilitation Center directed by physiatrist. Wide variety of treatment program. Coordinated physical, occupational, speech-hearing, psychological, vocational and social services. Excellent personnel policies and working conditions. Contact R. A. Silvanik, Administrator, The Rehabilitation Center of Summit County, Inc., 326 Locust Street Akron 2, Ohio.

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QUALIFIED PHYSICAL THERAPIST for immediate placement on staff of modern, well equipped, expanding department of 300-bed general hospital. Located in progressive university city of 40,000. Excellent opportunity for professional advancement. Contact: Mr. James E. Roetto, Chief Physical Therapist, Jackson-Madison County General Hospital, Jackson, Tennessee.

PHYSICAL THERAPIST: State Crippled Children's program. Full team approach. Car provided for official use, 4 weeks' vacation, under Merit System. Retirement benefits. Salary range: PT-I, $4,500-$5,220; PT-II, $4,860-$5,580. Write to Mr. Joseph Taylor, Coordinator, Physical and Occupational Therapy Department, Crippled Children's Services, State Board of Health, Dover, Delaware.

POSITIONS AVAILABLE

Openings for two staff physical therapists, registered, or eligible for registration. Opportunity to work in one of country's finest cerebral palsy clinics under experienced superior. Advantages of correlation with interesting research. Salary commensurate with education and experience. Fringe benefits Blue Cross, Blue Shield, Health Insurance, retirement and social security plan. Contact: Personnel Director, Indiana University Medical Center, 1100 West Michigan Street, Indianapolis 7, Indiana.

STAFF PHYSICAL THERAPIST: Teaching institution, adequate facilities to continue professional development. Benefits include: Blue Cross, forty-hour week—Monday through Friday—three weeks vacation, sick leave—two weeks—laundry of uniforms. Salary $366 per month, social security, and workmen's compensation. Contact: Educational Director, Physical Therapy, University of Texas, Medical Branch, Galveston, Texas.

STAFF PHYSICAL THERAPIST: Experienced to supervise expanding department in 518-bed general hospital; wide variety of cases divided between in- and outpatients; 5 day week, liberal fringe benefits. Apply Personnel Dept. St. Joseph's Hospital, Main St., Paterson, N. J.

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PHYSICAL THERAPIST—Chief therapist for modern, 100-bed general hospital. Therapist aide trained by present Chief Therapist available to assist. Affiliation with Board Psychiatrist at teaching hospital 35 miles away. Starting salary $4,400 to $4,800 per year with excellent fringe benefits. Three major ski areas within 5 to 20 miles of hospital. Summer recreational activities excellent; 125 miles from Boston, Mass. Apply to Administrator, Springfield Hospital, Springfield, Vermont.

Staff Physical Therapist: modern, 335-bed general hospital. Treat inpatients and outpatients; 2 wk. vac., retirement plan plus social security, hospitalization, laundry of uniforms, 40-hr. wk., $335 per mo. Write Personnel Director, Baptist Memorial Hospital, 800 Miami Rd., Jacksonville 7, Fla.

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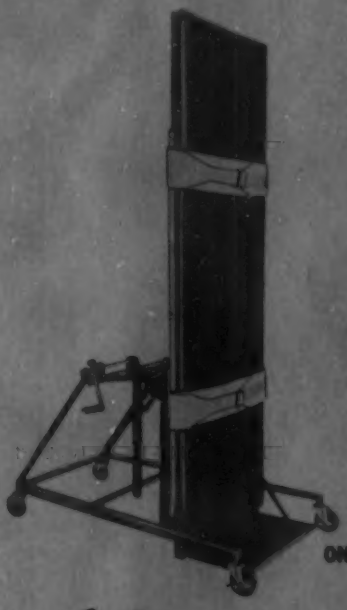

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